THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

Vol. XXVII. No. 663.] LONDON, JANUARY 25, 1876. [28th Year.] Price 6d.

RAMSAY'S NEWCASTLE CANNEL COAL. Analysis—10,000 cubic feet of gas per ton of coal: 26-candle gas; 13¼ cwt. coke per ton of coal.
The London Exhibition in 1851 was lighted with gas made from Ramsay's Cannel.
RAMSAY'S PATENT CONDENSED COKE.
DO. GARESFIELD COKE.

RAMSAY'S FIRE-CLAY ARTICLES.
GAS-RETORTS, introduced 1808. FIRE-BRICK WORKS, established 1804. FIRE-CLAY SANITARY PIPES, CHIMNEY-TOPS, and all Goods made of Fire-Clay. The Fire-Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article. The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the Works are the most extensive in the Kingdom.
Manufactories—Derwenthaugh, Swalwell, and Hebburn Quay, near Newcastle-on-Tyne; and London Wharves—Falcon Wharf, No. 80, Bankside; and Honduras Wharf, Cubitt Town. Large stocks kept.
Address G. H. Ramsay, Newcastle-on-Tyne.

GENUINE TORBAY PAINT
AND
SPECIAL GASOMETER PAINT
(Mixed ready for use).

These Paints are now used in 100 Country Gas-Works, and by all (but one) of the London Gas Companies, on Gasholders, Scrubbers, Purifiers, &c. They will cover tar effectually. Also used by the Admiralty, War Office, Railway Companies, Founders, &c.
They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations.
The covering powers are considerably greater than those of any other Paint.—*See "Engineer," Nov. 2, 1866.*
STEVENS & CO.,
(Successors to Samuel Calley. Established 20 Years.)
21, GT. WINCHESTER ST., LONDON.
Works: BRIXHAM, TORBAY.

THOMAS PROUD,
MANUFACTURER OF
WOOD GRIDS
FOR
SCRUBBERS
AND
PURIFIERS.
BROOKFIELD IRON-WORKS,
103, ICKNIELD STREET EAST,
BIRMINGHAM.

COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, BLAYDON-ON-TYNE,
Were the only parties to whom a Prize Medal was awarded at the Great Exhibition of 1851, for "Gas-Retorts and other Objects in Fire-Clay," and they were also awarded, at the International Exhibition of 1862, the Prize Medal for "Gas-Retorts, Fire-Bricks, &c., for Excellence of Quality."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.
COWEN'S GARESFIELD COALS.
Coal Office,
Quay Side, Newcastle-on-Tyne.
Jos. Cowen & Co. are the only Manufacturers of Fire-Bricks and Clay Retorts at Blaydon Burn.

JOHN RUSSELL AND CO.,
THE WEDNESBURY TUBE-WORKS, WEDNESBURY;
AND
THE ALMA WORKS, WALSALL.
Established at the commencement of Gas Lighting.
Warehouses:
69, UPPER THAMES STREET;
COMMERCIAL STREET, SPITALFIELDS;
5, CHARLES STREET, SOHO; and
16, SOHO SQUARE,
} LONDON
36, 36, 37, & 39, GRANBY ROW, MANCHESTER.
J. R. and Co. are the original manufacturers of Wrought-Iron Gas Tubes and Fittings, and Inventors of the LAP-WELDED TUBES for Locomotive and Marine Boilers.
J. R. and Co. make all kinds of Tubes and Fittings for Gas, Steam, and Water; Gun-Metal Cocks, Stocks, and Dies; Galvanised Tubes and High-Pressure Tubes, &c.
Lists may be obtained on application to
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JOHN BENT & SON,
BELL BARN ROAD, BIRMINGHAM,
MANUFACTURERS OF
WET AND DRY GAS-METERS,
OF
FIRST-CLASS MATERIALS & WORKMANSHIP;
Also, STATION-METERS, PRESSURE-GAUGES, STREET-LAMPS, REGULATORS, &c.
Established 1830.

THOMAS PIGGOTT & CO.,
SPRING HILL, BIRMINGHAM.
MANUFACTURERS OF
TELESCOPIC & SINGLE GASHOLDERS,
CAST & WROUGHT IRON TANKS FOR DITTO,
And Gas Apparatus of every Description.
Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.
Sugar, Saltpetre, and all kinds of Pans.
Roofs, Girders, and Bridges, and General Smith's Work.
London Agent—W. G. DAVIS, 2, Brabant Court, Philpot Lane, E.C.

J. & H. ROBUS,
CONTRACTORS
FOR THE
ERECTION OF NEW & REMODELLING OF EXISTING GAS-WORKS.
RETORT-SETTING A SPÉCIALITÉ.
RETORTS SET, AND GUARANTEED TO BURN OFF A CERTAIN AMOUNT OF COAL, OR ELSE NO MONEY TAKEN FOR THE CONTRACT.
PLANS ON APPLICATION.
Retort-Setters sent to all parts of Europe and America.
Address, J. and H. ROBUS,
BELL GREEN, CATFORD, LONDON, S.E.

THE
NITSHILL COMPANY'S
DUKE OF HAMILTON'S
LESMAHAGOW
CANNEL COAL.
AGENT:
JAMES M'KELVIE,
HAYMARKET,
EDINBURGH.

LONDON, 1862. CLASS X.
LONDON, 1862. CLASS XXXI.
PARIS, 1867. SILVER MEDAL.
AMSTERDAM, 1869.
DIPLOMA D'EXCELLENCE.
VIENNA, 1873. THE ONLY MEDAL.
MANCHESTER, 1875. SILVER MEDAL

GEORGE GLOVER & CO.,
MANUFACTURERS OF
IMPROVED DRY GAS-METERS,
WARRANTED TO MEASURE CORRECTLY, AND NOT TO VARY.

EXTENSION OF PREMISES.

G. G. & Co. having had their premises entirely rebuilt, are now fairly in possession of large and commodious workshops, specially adapted to the requirements of the trade, and they are prepared to execute orders, large or small, with promptness and despatch.

THEY KEEP IN STOCK METERS OF ALL SIZES, UP TO 300 LIGHTS.

RANELAGH WORKS, RANELAGH ROAD, PIMLICO,
LONDON, S.W.;
236, GEORGE STREET, GLASGOW; and 30, LANCASTER AVENUE, MANCHESTER
AGENT FOR AUSTRALIA:
Mr. A. DEMPSTER, POST-OFFICE PLACE, MELBOURNE.

G. G. & Co. have just been awarded a SILVER MEDAL for Gas-Meters and Gas Apparatus at the Exhibition of the "Society for the Promotion of Scientific Industry," Manchester.

SILVER MEDAL, PARIS EXHIBITION, 1867.

LLOYD AND LLOYD,

ALBION TUBE-WORKS, BIRMINGHAM,

MANUFACTURERS OF

WROUGHT-IRON TUBES AND FITTINGS

AND

LAP-WELDED IRON AND HOMOGENEOUS METAL BOILER TUBES.

Boiler-Tube Ferrules, Gun-Metal Gland Cocks, Water-Gauges, Whistles, &c.; Stocks, Taps, and Dies for Screwing, and Gas-Fitters Tools.

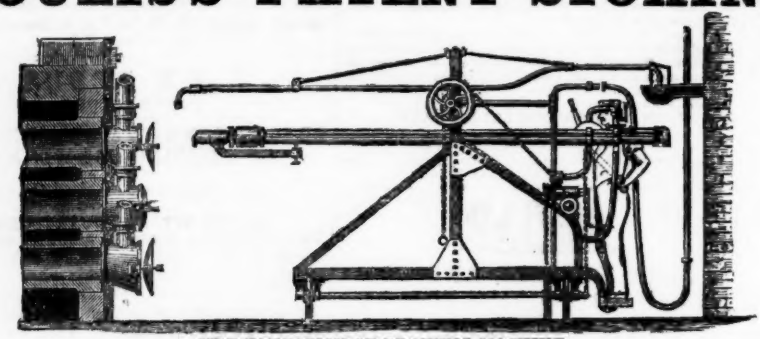
London Offices: No. 4, Cloak Lane, Queen Street, E.C.

WAREHOUSES:

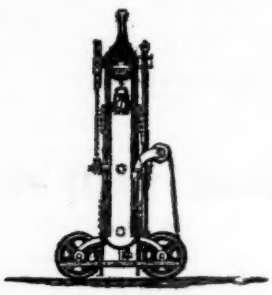
LONDON: 157, UPPER THAMES STREET, E.C.

LIVERPOOL: No. 63, Paradise Street.
MANCHESTER: Barlow's Croft, Chapel Street, Salford.
PARIS: No. 38, Rue du Chateau d'Eau.
LILLE: No. 38, Rue Grande Chaussee.

FOULIS'S PATENT STOKING MACHINE.



SIDE ELEVATION OF DRAWING MACHINE.



END ELEVATION.

(*The Charging Machine will be Illustrated in next week's Advertisement.*)

Makers: TANGYE BROTHERS and HOLMAN, London and Birmingham; ADAM WOODWARD and SON, Manchester; ROBERT LAIDLAW and SON, Glasgow; MASCHINENBAU-ACTIEN-GESELLSCHAFT HUMBOLDT, Kalk bei Deutz;
Or all particulars may be had from JAMES WOTHERSPOON, 31, St. Vincent Place, Glasgow.

Established

1795.

JOSEPH CLIFF & SON,

THE ORIGINAL

WORTLEY FIRE-BRICK WORKS,

NEAR LEEDS,

MANUFACTURERS OF ALL DESCRIPTIONS OF

FIRE GOODS, and Salt-Glazed Drain-Pipes.

LONDON WHARF:

Wharf No. 4, inside Great Northern Goods Station, King's Cross, N.;

LIVERPOOL—1, Back Leeds Street,

Where is always kept a Stock of Retorts, Fire-Bricks, Terra Cotta Ware, and Drain-Pipes.

TRADE MARK

THE MEDAL FOR 1862.

The only Prize Medal awarded for TUBES & FITTINGS.

CROWN TUBE-WORKS,

WEDNESBURY, STAFFORDSHIRE.

WAREHOUSE: SOUTHWARK STREET, LONDON.

JAMES RUSSELL & SONS, LIMITED,

PATENTEES & FIRST MAKERS OF WROUGHT-IRON TUBES,

ONLY MAKERS OF HOMOGENEOUS METAL TUBES.

MANUFACTURERS OF

TUBES and FITTINGS for GAS, STEAM, and WATER;
LAP-WELDED, LOCOMOTIVE, MARINE, and other BOILER TUBES;
HYDRAULIC TUBES, BEDSTEAD TUBES, WELL TUBES, TELEGRAPH POSTS, COILS, &c.;
GAS-FITTERS TOOLS, VALVES, COCKS, &c.

THOMAS PIGGOTT & CO.,

(Established 1822,)

SPRING HILL, BIRMINGHAM.

MANUFACTURERS OF

TELESCOPIC & SINGLE GASHOLDERS,

CAST & WROUGHT IRON TANKS FOR DITTO;

PURIFIERS, CONDENSERS, SCRUBBERS, RETORTS, VALVES;

IMPROVED WROUGHT-IRON RETORT-LIDS, CROSS-BARS, & SCREWS;

AND GAS APPARATUS OF EVERY DESCRIPTION.

SOLE MANUFACTURERS OF LIVESEY'S PATENT GASHOLDER MAN-LID,

By use of which Man-lid, inlet and outlet pipes can be examined and cleansed without loss of gas in crown of holder, or ingress of atmospheric air.

ROOFS, GIRDERS, BRIDGES, AND BOILERS OF ALL KINDS.

Drawings, Specifications, and Estimates supplied on application.

London Agent: W. G. DAVIS, 2, BRABANT COURT, PHILPOT LANE, E.C.

THE

LANCASHIRE GAS-METER COMPANY,

LIMITED,

FALCON STREET, OLDHAM,

MANUFACTURERS OF

GAS-METERS, GOVERNORS, EXPERIMENTAL GASHOLDERS, &c.

HENRY THOMAS, Managing Director.

JOHN WRIGHT AND CO., ESSEX WORKS, BIRMINGHAM,

Beg to call the attention of MANAGERS and DIRECTORS of GAS COMPANIES to the following letter which they have lately received.

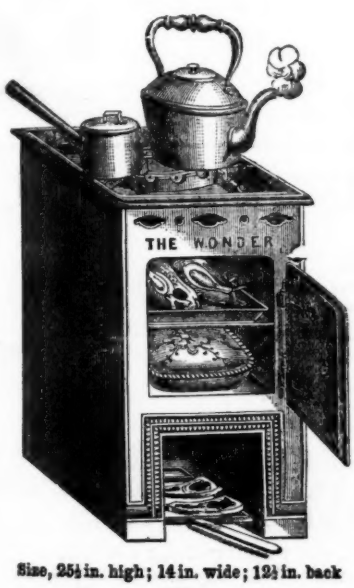
COPY OF LETTER RECEIVED FROM MAGNUS OHREN, Esq.

Crystal Palace District Gas Company, Lower Sydenham, S.E.

To Messrs. John Wright and Co., Essex Works, Birmingham.

Dear Sirs,—In reply to your inquiries, I am glad to state that the use of GAS COOKING AND HEATING STOVES has been a complete success here. We have several hundred in use in our districts. We also find it advantageous to let out Stoves at a small rental. We have now 275 Stoves at rent.

The Stoves you make I can with confidence recommend, having so many in use, and giving satisfaction. I need scarcely point out to you the advantage to Gas Companies to recommend the use of Gas Stoves to their Gas Consumers, even where they do not supply them on sale or rent, as the use of Gas Stoves brings day consumption, and thus the Company make a profit by day as well as by night.—I am, dear sirs, yours faithfully, MAGNUS OHREN.



Size, 25½ in. high; 14 in. wide; 12½ in. back to front.

Price 50s., complete with Pan and Gridiron.

GAS HEATING STOVES

(TERRA COTTA AND IRON).

THE CHEERFUL STOVE.

COOKING STOVES.

BREAKFAST COOKERS.

BATHS HEATED by GAS

GAS STOVES

For Boiling, Broiling, Preserving, Heating Flat Irons, and for all other Domestic Purposes.

Gas Companies and the Trade who have not our Illustrated Catalogue are respectfully requested to apply for same.

A LIBERAL DISCOUNT to the TRADE.

No. 4003.

THE CHEERFUL GAS STOVE, with Copper Reflector,

Has all the appearance of a Bright Fire.

PRICE from 32s.

THE

IMPERIAL METER COMPANY,

LIMITED,

KING'S ROAD, LONDON, N.W.,

OFFICE: 115, VICTORIA STREET, WESTMINSTER, S.W.,

MANUFACTURERS OF

"WET" & "DRY" GAS-METERS IN IRON & TIN-PLATE CASES,

STATION-METERS AND GOVERNORS, STREET-LAMP METERS, BOXES, AND REGULATORS FOR THE AVERAGE METER SYSTEM.

TO GAS COMPANIES, ENGINEERS, &c.

These Works are in full operation, and it will be the aim of the New Company not only to keep up the excellent workmanship of their predecessors, but, by the introduction of special machinery, to manufacture **Meters of a higher standard than is usually given, without increasing the cost.**

Special attention is invited to the Compensating Wet Gas-Meter of De Castro and Burton, which is now becoming so generally adopted, and is more simple in construction than any other Compensating or Ordinary Wet Meter. There is but one centre of friction to be overcome by the gas. By its self-adjusting principle it maintains an unvarying water-line; and the reservoir contains sufficient water to supply the Meter for twelve months without attention. It is unaffected by "tilting," and cannot be "flooded" by any pressure.

The Company also manufacture Dry Meters upon the most improved principle, and all their Meters being made to standard gauges, the most accurate measurement is obtained.

Attention is also called to their Dry Meters in Wood Cases, as used by some of the London Gas Companies. These Cases are a great preservation to Tin-plate Meters, especially in seaport towns, where the air is impregnated with salt; they are also particularly suited for export.

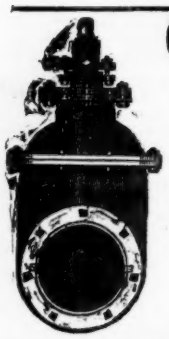
The Company repair or convert every description of Wet Gas-Meters to De Castro and Burton's Patent.

JOSEPH AIRD,

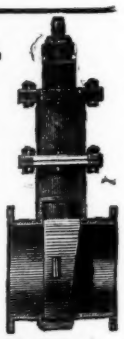
WELLINGTON TUBE-WORKS, TIPTON, STAFFORDSHIRE,

MANUFACTURER OF

EVERY DESCRIPTION OF TUBING, GAS, STEAM, HYDRAULIC TUBES AND FITTINGS,
EITHER BLACK, GALVANIZED, OR ENAMELLED HOT WATER TUBES AND FITTINGS,
CORE BARS, COILS, COCKS (IRON OR BRASS),
CHANDELIERS, &c., GAS-FITTERS' TOOLS, GAS TONGS, STOCKS, TAPS, DIES, &c., &c.,
HANDRAIL TUBINGS, IRON AND BRASS, PLAIN OR TWISTED,
TELEGRAPH TUBES OR POLES, &c., &c.



C. & W. WALKERS' DOUBLE-FACED GAS-VALVES.



These solidly constructed double-faced Gas-Valves have taken the place of the old system of the light, single-faced disc, which is too uncertain and unreliable in large bores.

They are guaranteed absolutely gas-tight. They are very massive and rigid, and by improved modes of manufacture they are produced at very little excess in cost over the old light, weak system, which is liable to spring and bend, and become leaky.

The Valve is a rigid wedge of solid cast iron, having two perfectly scraped surfaced facings fitting between the two on the body, which are also surfaced.

A spring in two short halves, and, therefore, not liable to break, is used only for scraping the front facing clean.

The front facing is vertical; the back facing forms the wedge.

At a slight additional expense both flanges are faced to bolt to main-pipes.

MIDLAND IRON-WORKS,

DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

WEST'S GAS IMPROVEMENT COMPANY,

LIMITED,

ARE NOW PREPARED TO SUPPLY AND ERECT THEIR PATENTED MACHINERY FOR

CHARGING AND DRAWING GAS-RETORTS,

And to enter into arrangements with GAS COMPANIES for its use upon moderate terms of Royalty.

The Patented Machinery has secured the approbation of all Engineers who have visited the MAIDSTONE GAS-WORKS, *where it is in full operation, and may be inspected at any time on application to the Manager.*

The advantages attending its use are—

INCREASED VOLUME OF GAS PER TON.—INCREASED YIELD PER RETORT.—INCREASED BULK OF COKE FOR SALE.—REDUCTION IN LABOUR AND LESS DEPENDENCE ON SKILLED STOKERS.

A Pamphlet containing a description of the Machinery, and Copies of Reports on the working of the same, &c., will be forwarded on application to the MANAGING DIRECTOR, Maidstone. Communications may also be addressed to the Consulting Engineer, R. P. SPICE, Esq., M. Inst. C.E., 21, Parliament Street, London, S.W., or to the Engineer and Analyst, F. W. HARTLEY, Esq., A. Inst. C.E., 55, Millbank Street, London, S.W.

WILLIAM SUGG,

GAS ENGINEER,

VINCENT WORKS, VINCENT STREET,

WESTMINSTER, S.W.

WILLIAM SUGG'S LATEST IMPROVEMENTS IN GAS-BURNERS.

The "LONDON" ARGAND BURNER, with SELF-ACTING GOVERNOR (Patent).

"Westminster" Pattern Shade, as used in the Ministers Rooms and Lobbies of the Houses of Parliament.

This Burner is No. D size, and, with a consumption of 5 cubic feet per hour, gives about 2 candles more light than the Gas Referees model, called the No. 1 "London" Argand Burner.

Numerous other pattern Shades, Plain or Ornamental, may be obtained with these Burners.

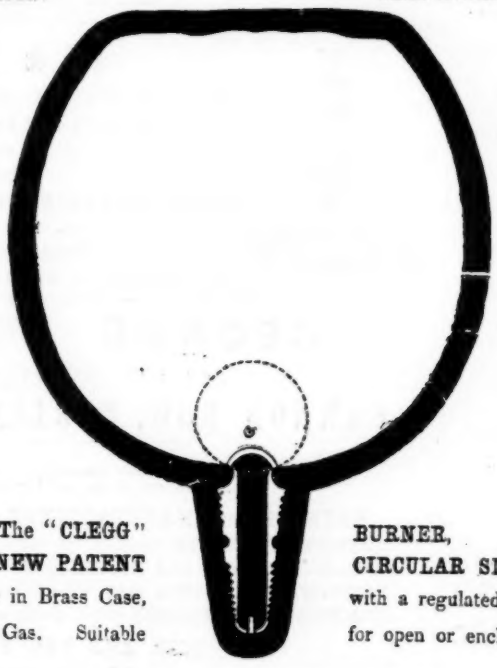
The "CHRISTIANIA" FLAT-FLAME BURNER, with SELF-ACTING GOVERNOR (Patent).

This Burner has been pronounced by the most eminent Engineers of the day to be the perfection of a flat-flame Burner.

The Shades, which are made in a beautiful white glass called Albatrine, are manufactured *exclusively* for these Burners, and cannot be obtained elsewhere.

The light emitted from these Burners is very white and soft to the eyes, and is about 30 PER CENT. superior to the ordinary fishtail.

The Shades may be had either Plain or Ornamental,



The "CLEGG" with the NEW PATENT

Is a flat-flame Burner in Brass Case, admission of Gas. Suitable

BURNER, CIRCULAR SLIT,

with a regulated opening for the for open or enclosed Lights.

Price Lists and Prospectuses, with description of all the "London" Argand and other Burners, and their proper Shades, Supports, &c., forwarded post free on application.

SZERELMEY Liquid Enamel, for Iron-work exposed to the atmosphere, supersedes paint, dries in two hours, absolutely prevents rust, contains no oil, requires no mixing, is ready for use, is laid on like paint, covers new or old iron or wood, old paint, tar, or whitewash, is waterproof, gives a fine polished surface, and costs scarcely one-fourth as much as paint—namely, one halfpenny per square yard. Samples to any address for 12 stamps. Particulars free on application.

SZERELMEY Iron Paint has stood the test of 24 years experience. The gilding on the Victoria Tower of the Houses of Parliament was laid on over it upwards of 20 years ago, and is still in perfect condition.

SZERELMEY Stone Paint thoroughly waterproofs brick and other walls without giving them the appearance of having been painted.

COPIES of Reports on the Szerelmey compositions, by Sir Charles Barry, Sir R. J. Murchison, and Professor Faraday (printed by order of the House of Commons), with other information, may be had on application.

NONE of the Szerelmey compositions contain white or red lead, arsenic, or any other injurious ingredient. When in use and while drying they have a purifying effect on the atmosphere.

SZERELMEY Liquid Enamel.—The cost of the Enamel when laid on is about one halfpenny per square yard. We are now entering orders for execution at any time before the end of March at £25 per ton, subject to a liberal discount for cash, particulars of which we will send, if asked. A ton measures about 125 gallons, and is ready for use.

SHIPPERS will receive liberal treatment at our hands. They will find that our Enamel Paste can be supplied for shipment at a price with which no ordinary paint can compete.

SZERELMEY Debentures.—Investors desirous of subscribing for the remainder are requested to intimate their intention as early as possible. The debentures will be dated Jan. 1, 1876; from that date interest at 8 per cent. per annum (for which coupons are attached) will be paid quarterly. No prospectus will be advertised, but full particulars will be sent in reply to any application addressed to N. C. SZERELMEY AND COMPANY, Limited, 24, City Bank Chambers, Threadneedle Street, LONDON, E.C.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time, labour, and expense:

For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, Gas-Works, Hampton Wick, MIDDLESEX.

BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

Communications addressed to J. SUGG & CO., GHENT, will receive immediate attention.

FIRE-CLAY RETORTS.

WILLIAM FRASER,

INVERKEITHING,

Owner of the Works at which Fire-Clay Retorts were first made), can supply

RETORTS, FIRE-BRICKS, &c., to any extent.

References can be given to managers of above a hundred Gas-Works whom he supplies.

He ships at Charlestown his CELEBRATED HALBEATH STEAM COALS, on Navy List.

JAMES NEWTON & SONS,

(Established 1820,)

FIRE-BRICK AND TILE MERCHANTS,

Wholesale and for Exportation,

FALCON DOCK, 78 AND 79, BANKSIDE,

SOUTHWARK, LONDON, S.E.,

DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and FIRE-CLAY, and every Article suitable for

GAS AND WATER WORKS.

LAMP-PILLARS,

GAS-LAMPS, FOUNTAINS.

Our New and Choice Designs for the above, with prices, are forwarded to any part of the world on receipt of twelve stamps. Estimates for work at home or abroad.

W. T. ALLEN & CO.,

GAS & WATER ENGINEERS & CONTRACTORS,

203, UPPER THAMES STREET,

LONDON, E.C.

J. & J. BRADDOCK,

GAS ENGINEERS,

GLOBE METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET & DRY CONSUMERS GAS-METERS,

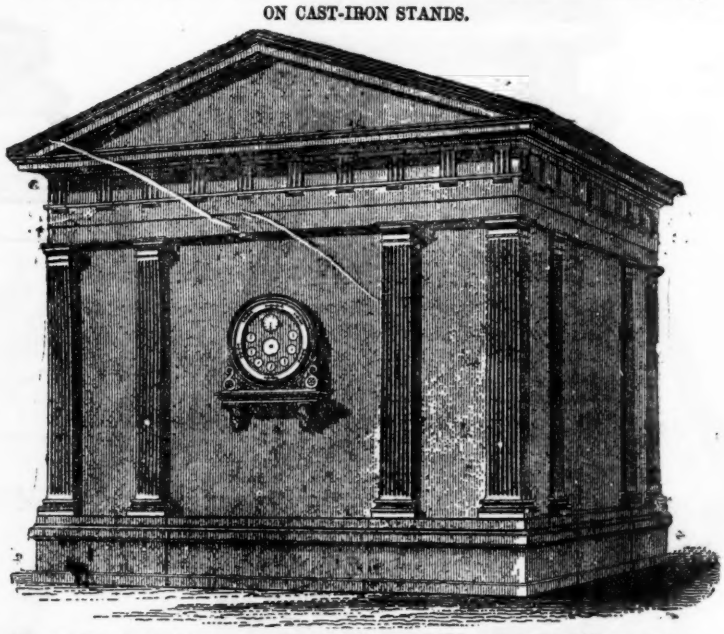
OF THE HIGHEST EXCELLENCE;

ALSO LICENSEES AND MANUFACTURERS OF

WARNER & COWAN'S PATENT SELF-REGULATING GAS-METERS;

ROUND STATION-METERS,

ON CAST-IRON STANDS.



SQUARE STATION-METERS,

WITH PLANED JOINTS.

GOVERNORS, GAUGES, INDICATORS, MAIN COCKS, &c.

GAS COOKING APPARATUS.

Home and Foreign Orders promptly attended to.

All Sizes of CONSUMERS METERS, STATION-METERS, and GOVERNORS generally in Stock.

Orders almost invariably despatched on the day of receipt.

TERMS, &c., ON APPLICATION.

F. & C. OSLER,

45, OXFORD STREET, LONDON, W.

MANUFACTORY AND SHOW-ROOMS:

BROAD STREET, BIRMINGHAM.

ESTABLISHED 1807.

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,

WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.

TABLE GLASS OF ALL KINDS.

CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.

GEORGE ANDERSON,

GAS AND CONSULTING ENGINEER,

4, CANNON ROW, PARLIAMENT STREET, S.W.

MR. ANDERSON advises Companies on all matters connected with the manufacture of Gas and the construction of Works.

PATENTEE and MANUFACTURER of the following Inventions:—

RETORT SETTINGS, heated by tar without the production of smoke.

STEAM-ENGINES and EXHAUSTERS, separately or combined.

FOUR-WAY VALVES, one of which is equal to three ordinary Valves.

STATION GOVERNORS—the Gasholder cannot tilt and cause accident.

BREEZE AND TAR FUEL MACHINE.

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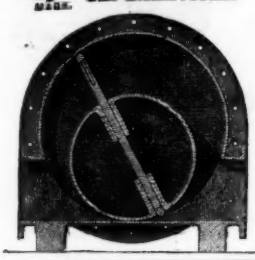

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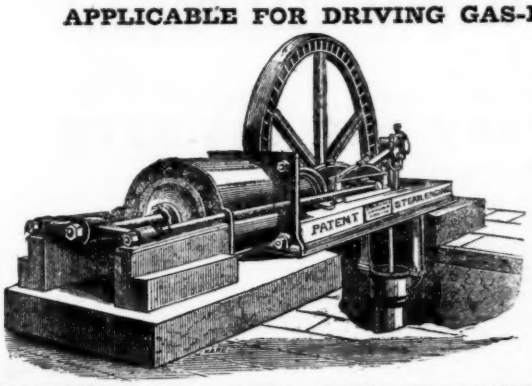

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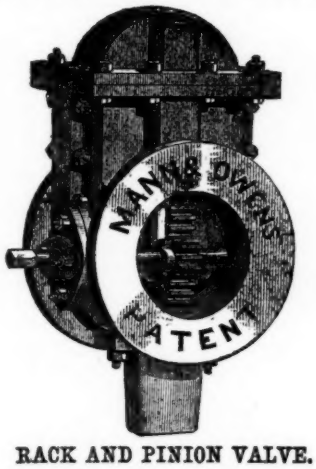

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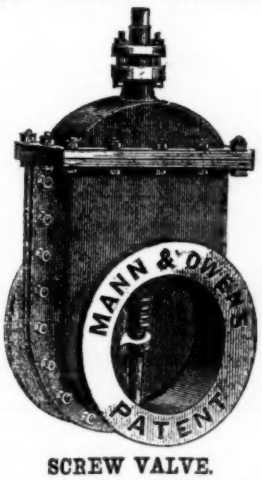

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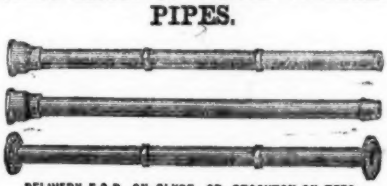

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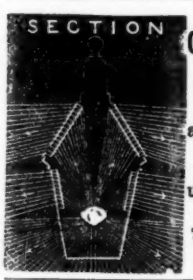

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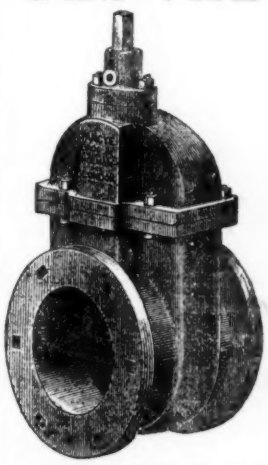

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THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 25, 1876.

Circular to Gas Companies.

The veil which conceals the doings at the conference of some of the metropolitan gas companies and the authorities, at the Board of Trade, has not yet been lifted. Contradictory rumours are afloat; and that one which states, that the companies gave in their submission to the terms of the local authorities, is not, we should think, to be credited. The simple fact that such complete secresy is observed, conclusively shows that nothing has been settled. The moment an agreement is come to, or whenever negotiations are altogether broken off, we shall know all about it. We must take it, then, that, at the present time, nothing definite has been determined upon, and that the companies most concerned have not yet made up their minds as to whether or not the Regulations Bill is likely to operate to their interest. The Chartered Company would, of course, accept the measure with an advanced initial price; but we very much doubt whether the authorities will consent to any modification of the terms of their Bill. If Mr. St. George Burke, Q.C., may be accepted to express the views entertained at the board of the Imperial Company, they, too, would acquiesce in the measure, if they could have a guarantee that the authorities would accept it as a final settlement of the gas question, so that the companies might for the future exist in peace. Of course, no such guarantee can be given. It suits the purpose of some members of the authorities to say to-day, that they care not what profits gas companies make, if gas be supplied for less than 3s. 9d. per 1000 feet. But that view of the case is by no means shared by the general public; and we feel satisfied that the moment a larger dividend than ten per cent. is declared, there will be an outcry, no matter what is the price of gas. There will again be a clamour for fresh and more restrictive legislation, and we do not see how the local authorities could resist it. The public have been educated to believe in settled maximum dividends, and, unless we are much mistaken, will be greatly disturbed if these be ever exceeded. It cannot be supposed that we have any objection to see a gas company make large profits. Our desire would be quite the other way; and, but for the sake of peace and quietness, we should rejoice to hear that any company had divided twelve or thirteen per cent. But we feel satisfied that such an announcement would be followed by a burst of public indignation. We gather this from the proceedings of the Lambeth Vestry, reported in our last, on which we shall make no further remarks.

Assuming, then, that nothing has been settled, that a hopeless disagreement may prevail, and that there exists a real desire (which we can well understand does exist on the part of some) to save another long parliamentary inquiry, the question arises, how is a settlement to be arrived at? The parties to the dispute are the Board of Trade, the metropolitan local authorities, and certain of the gas companies. A disinterested arbitrator is required, who, possessing an extensive knowledge of the question, will give a full and fair consideration to the case. Such an arbitrator would be found in the person of Lord Redesdale, who must, in the long run, be called upon to express his opinion. Our readers know that we have not approved all his lordship's decisions; we have not agreed with his limitations of dividends, for example; but still we believe that he acts conscientiously in what he considers to be the public interest, and we are certain that he is anxious to preserve what he conceives to be the just rights of private enterprise. We believe, then, that both consumers and companies may place their case in his hands, with the satisfaction of knowing that justice would be done. The suggestion we now throw out may be taken for what it is worth. We have no object for stopping another parliamentary contest. On the contrary, so far as our own interests are concerned, we might desire one. But for the sake of that innocent public, who ultimately pay all the costs, we shall be glad to see the contest avoided. For this reason, we should be satisfied to see Lord Redesdale's assistance invoked. The whole matter must eventually come under his notice, and it would save time and expense if his opinions were ascertained at once.

We commence, to-day, our notice of the Bills to be promoted, in the next session, by provincial gas companies. It will be seen that they all proceed on the old lines. They all propose to raise share and loan capital in the usual proportions. The dividends are, in most cases, to be limited to seven per cent. and six per cent., according as the share capital is issued in ordinary or preference shares. In a few cases no limitation is proposed, other than that which is involved by the incorporation of the general Acts; but, doubtless, in these cases, Lord Redesdale's very decided views on the matter will be clearly expressed.

The new capital is, in all cases, to be raised in £10 shares, in accordance with another whim of Lord Redesdale, and this, in the case of some of the companies seeking for incorporation, who have raised their original capital in £5 shares, necessitates consolidation, and the creation of half shares, which perplexes accountants. The absence of sound investments for small sums makes us regret that shares of a lower nominal value are not allowed. Small investors in this country can find no safe depository but the savings banks, with three per cent. In Paris they can have £4 shares in the gas company, and obtain 10 per cent. In America they can have £1 shares in gas companies. Such institutions as the Co-operative Credit Bank flourish for a time, because there are so few sound undertakings, yielding a reasonable rate of interest, accessible to small investors. We can conceive of no reason why £5 shares should not be allowed. The Bills we notice to-day will, if passed into Acts, authorize the raising of a little over a million of new capital, and if this were issued in shares of small nominal value, all classes of the community might participate in the profits.

We have said that the companies propose, for the most part, to proceed on the old lines of legislation. The Maidenhead Company offer an exception. They wish for a sliding scale of dividend. The standard price of 5s. 6d. per 1000 feet is proposed, and, if this price be exceeded or reduced by more than sixpence, then an increase or reduction of dividend is to take place as mentioned elsewhere. If this Bill should pass, it will offer the first example of an upward and downward scale of dividend in the case of a provincial gas company. We fully expected to see the sliding scale introduced into several Bills this year, but this is the only instance in which a country company have put it forward. Looked at in connexion with the standard price, it seems a good idea, and we hope the company will succeed.

The Isle of Thanet Gas Company belongs to a class which is now nearly extinct. They began business long before any general Act to govern the proceedings of gas companies was passed. They have never been in Parliament since they obtained their original Act in 1825; and, in the meantime, they have gone on expending money out of profits applicable to dividend on extensions of works, until the sum has reached £48,000 and upwards. We regard it as a mistake, that the company did not years ago apply for power to raise additional capital, under the restrictions which must have been imposed. A good deal of the misunderstanding now existing at Ramsgate and Margate would have been avoided, if such a course had been adopted. The company now seek power to capitalize these expended profits, as "Improvement "Stock," entitled to 10 per cent. The proposal is perfectly fair,

but at the present time the company will have to encounter the strenuous opposition of the local authorities in their district, which would not have been the case a few years ago. An impression has got abroad that the company are "rolling in riches," and could afford to sell gas for next to nothing. The idea is very absurd, but it seems to have taken a firm hold of the Ramsgate mind, and seeing that the local authority of that fashionable watering-place are promoting a Bill to effect a compulsory purchase of one undertaking of the company, we may expect a very keen parliamentary contest.

The Horncastle Gas Company, who come to Parliament for the first time, have also expended profits on extensions, and now seek to capitalize the amount. They ask, however, for only seven per cent. on that sum, which exhibits generosity, or shows that the company have not been well advised. Expended profits, when capitalized, have usually been placed in the same position as original capital, with which it is justly entitled to rank.

It will be seen, in our notice of the Bills, that 14-candle gas is now almost universally proposed. The exception this year is in a comparatively small district in Suffolk, in which coal must necessarily be dear, and in which, probably, residuals are drugs. There it is desired to supply twelve-candle gas, at a maximum price of 6s. 6d. per 1000 feet.

The maximum prices proposed may be said to range high, and it will astonish a metropolitan consumer to be told that, in the very centre of the Durham coal-fields—Spennymoor—power is asked to charge 5s. for fourteen-candle gas. Colliers, however, do not appreciate gas, and the waste from breakages of mains, in an undermined district, is very great, so the price is fully justified. With these remarks, we may conclude our notice of the gas Bills until next week, when we come to those promoted by local authorities.

We are sorry that we have not space this week for a report of the sensible lecture, delivered by Mr. M'Crae at Dundee, on, what we may call, the waste of gas by bad burners. Mr. M'Crae calculates that the waste in Dundee is equivalent to a loss of £15,000 per annum, and we have no doubt he is within the mark. The supply of rich gas, such as is furnished in Dundee, is a great mistake, and we are glad to see that our Scottish friends are beginning to recognize the fact. Fourteen or sixteen candle gas would suit them a great deal better. Their customers would then have more light and cleaner ceilings, while gas would be very much cheaper. As it is, cannel gas must be supposed to have reached its lowest price, and it cannot be long before it will begin to rise.

The Southampton Guardians are somewhat jubilant over their equivocal triumph, in getting the rating of the gas company referred to arbitration, and they cheerfully drew a cheque, at their last meeting, for £500, to pay the first instalment of the expenses. It is with no pleasure that we refer to cases of this kind, and, at the present stage of the proceedings, we can only hope that the case of the company is so strong that they can successfully resist what, at first sight, looks very like an attempt at extortion.

The gas agitation at Liverpool has broken out again in a rather virulent form. A deputation of consumers have waited upon the Gas Committee of the Corporation with a memorial requesting that the attention of the Recorder may be called to the 35th section of the Gas-Works Clauses Act, 1847, in which it is enacted that, on the petition of any two gas ratepayers, a court of Quarter Sessions in England may appoint an accountant to examine the accounts of the company. The proceedings of the memorialists appear to us altogether wrong. Any two of them might have presented a petition to the court, and their case must have been heard. To call upon a public body to request a judge to pay attention to such a petition, looks to us like an imputation on the character of the judge, which, in the case of the Recorder of Liverpool, we are certain is not deserved. In connexion with metropolitan gas affairs, we have recently contended that the existing law gives every protection to gas consumers if they will only be at the trouble to enforce it. In Liverpool, it would seem that some attempts have been made, in past times, to put the provisions of the Act of 1847 in force, but never in a shape of which the Recorder could take cognizance. We feel certain that the learned Recorder of Liverpool will resent any attempt on the part of the Town Council to teach him his legal duties. The gas consumers have their remedy, if they will only take proceedings as the law directs. We say this, while we believe that, as a matter of fact, the consumers have nothing to complain of. The United Company supply gas considerably in excess of the statutory requirements. They do this, we might say, reckless of expense. They make no attempt at the removal of carbonic acid (which is of no moment to the consumer), and they keep up the illuminating power by the liberal use of cannel. The result, in any case, is that, as any one can see who walks about the streets, the gas is of most excellent quality. So far, then, the consumers have no grievance; but they object to the price, which appears to be fourpence per thousand more that it is in Manchester, for gas of, we think, rather less illuminating power. The reason for this difference is palpable to any one who understands the circumstances of the two cases; but we suppose it will always be a puzzle to some to know why a gas company existing for profit cannot compete with a corporation who commenced the manufacture of gas in the infancy of gas-making, and have carried on the undertaking ever since with public money. But there is another grievance at Liverpool, and that is the exaction of deposits. We have more than once noticed reports that the deposits at Liverpool are excessive. It is now said that the sum in the hands of the company amounts to £45,000. On this sum the United Company are not required to pay interest; but we may fairly assume that it is employed as trading capital, in substitution of capital which would be entitled to ten per cent., and, therefore, does, in reality, assist in keeping down the price of gas. We do not further defend the action of the company, except on the ground that they are legally justified in exacting deposits, and are not legally required to pay interest thereon. Perhaps the gas-fitters are at the bottom of the present agitation. They complain that the company compete with tradesmen in the matter of fittings, and rather rejoice over the fact that this brought grief on the company by the destruction of the landing-stage. The memorialist consumers received the assurance of the Corporation Gas Committee, that no part of the cost of reconstructing the landing-stage should fall upon them. How it is to be prevented we do not see; but Dr. Cross evidently knows all about it. We shall clearly have a good deal to report on gas affairs in Liverpool, and we may leave them to-day without further remark.

The last act of the Birmingham and Staffordshire Gas Company is being performed. The last dividend has been distributed, and the company are now dividing the cash balance which remained. We are glad to see that in the appropriation of this balance the directors are not unmindful of their officers and servants; they have rewarded themselves, we feel bound say, at a very modest rate. If they had taken £2000 instead of £1000, we feel certain no shareholder would have objected, for all know that the affairs of the company have been admirably managed. The amount to be distributed among officers and servants is £5516, which we gather will be distributed as gifts among the oldest and most tried officers and servants of the company. There then remains a balance of about £67,000 for division among the shareholders, in the proportions mentioned in another column. In the course of next month the company will be wound up, and become a thing of history. Much as we regret to see gas undertakings pass into the hands of Corporations, we must in this instance congratulate all parties on the transaction.

Mr. Arthur Silverthorne, C.E., has just published a revised edition of his pamphlet on "The Transfer of Gas-Works to Local Authorities,"* which we commend to the notice of our readers. There is hardly a word in the introductory chapter with which we can agree; but we have but little space in which to discuss the ideas put forth by Mr. Silverthorne. He is an out-and-out advocate of purchase, on the ground, if we understand him, that the profits of a gas undertaking ought to reduce rates. We should have been glad if, in the subsequent chapter, in which the author gives an account of the purchases actually made by local authorities, he had told us something about rates, and given us figures, showing what influence the purchase of the gas undertaking has had upon them. To elucidate this matter, we are aware, would necessitate a wide inquiry. We have attempted it, and, after a comparison of some Yorkshire and Lancashire towns, some supplied with gas by Corporations, and others by companies, we came to the general conclusion that the rates, in all cases, were pretty nearly equal. A fair comparison is, however, attended with many difficulties, and we express no decided opinion on the question. We do not wish to conceal the fact that cheaper gas is equivalent to a reduction of rates, and that the application of gas profits to public improvements (which the author agrees with us in condemning) may save fresh impositions. But, then, it is sometimes the case, as at Manchester, that the possession of gas profits leads a Corporation into extravagance. Nor, even, according to Mr. Silverthorne, is a corporate undertaking always judiciously and successfully managed. We mention the cases of Dundee, Glasgow, and Leeds, as described by the author, as instances of purchases which have not been altogether advantageous to ratepayers.

There is one point on which we totally disagree with the writer. He remarks that "The principle of giving maximum dividends "to the shareholders of gas companies, for the sake of acquiring "works without opposition, is a gross miscalculation." We are

* "The Transfer of Gas-Works to Local Authorities, from the Year 1868 to 1875, with a Review of the London Gas Supply." London: Crosby, Lockwood, and Co. 1876.

not quite clear as to the meaning of the consideration he would substitute—viz., "the market price of a secured Corporation "annuity, equal in value to that of the company's stock, before "any rise of price, arising out of prospective purchase." There is here, we think, a distinction without much difference. The market price of the stock would depend on the dividends paid; and if, as the writer states, Corporation annuities have a much higher marketable value than the equivalent in gas stock, we are by no means certain that authorities would gain by following his suggestion. We remark, too, that, further on, the writer speaks of the Birmingham purchase, made by granting annuities equal to maximum dividends, as a decidedly cheap one. On the last chapter, dealing with the London gas supply, we shall have some remarks to make next week.

An agreement has been come to between the Burslem and Tunstall Gas Company and the Burslem Local Board, for the sale and transfer of the gas undertaking to the latter. The consideration is to be the payment of £80,000. The share capital of the company, as near as we can make out, is £8000 entitled to ten per cent., £15,000 entitled to seven-and-a-half, and £13,000 entitled to seven per cent.—in all, £36,000. When calculated out, the sum of £80,000 looks like twenty-eight years purchase of the several dividends, or about £244 for every £100 of capital invested.

Water and Sanitary Notes.

It is very difficult for a water company to please the Metropolitan Board of Works; nay, it may be said that it is impossible for them to do so. Before the Metropolis Water Act, 1871, was passed, there was, we rather think, a good deal of agitation on the question of street hydrants. The one thing necessary, it was urged, to save London from a general conflagration, was a plentiful supply of hydrants, always charged with water under great pressure. If we remember rightly, a deputation from the Metropolitan Board visited Manchester, where hydrants are in use, and, according to newspaper report, came back strongly impressed with their value as aids in the rapid extinction of fires. Well, the Metropolis is being gradually furnished with a constant supply of water under pressure, but so far as we know, not a single hydrant has been put up in any district so supplied. We are under the impression that the Board have ordered ten to be erected; but we do not remember to have heard that the order has been carried out. One consequence of having water mains constantly charged under pressure is, that the wooden fire-plugs are being frequently driven out, and much loss of water results. The Kent Water Company have suffered a good deal of this inconvenience, so they have now given notice to the Metropolitan Board that they intend to put up hydrants in the districts under constant supply, and charge the Board with the costs, as they are entitled to do, under the thirty-second section of the Metropolis Water Act, 1871. It is now discovered that hydrants are nothing but toys—mere "squirts," in fact—practically useless in extinguishing fires, and the Board refer the notice of the company to a committee for consideration. We hope the company will, nevertheless, carry out their plan, and may express a wish that the other companies, who are now giving constant supply, will follow their example.

The Water Committee of the Corporation of Liverpool, at their meeting last week, got no nearer to a decision as to the scheme they would recommend to the Council for the future supply. It seems to be understood, however, that an opinion in favour of sinking more wells gains ground. This we think, under the circumstances, would be the best course to pursue, for we feel certain that a ratepapers meeting would never consent to the expenditure of two or three millions on one of the large schemes propounded. When the insufficiency of the wells is demonstrated, the Town Council will have no alternative.

We may mention that the Municipal Association have had an interview with the Home Secretary, with the object of inducing him to procure some amendment of the Borough Funds Act. Mr. Cross, who probably had water affairs at Liverpool in his mind, confessed that the Act sometimes worked disastrously, but said he could not see his way to amend it. As none of the deputation, not even Sir Joseph Heron, could point out a mode in which the amendment could be effected, we presume the Act, as it stands, will continue to be law. We may congratulate ratepayers in general on this result, while we express a regret that they do not oftener display judicious liberality. Difficulties, however, seldom arise under the Act, as at Liverpool, when the local authorities have the full confidence of their constituents.

We mentioned, a week or two ago, that the Halifax Town Council had decided on purchasing the plant of the Goux Sanitary Manure Company, and to carry on the operations of the company on their own account. The negotiations, however, have fallen through, and the Council have now resolved to adopt some such plan for the removal of refuse, as that in use at Salford.

The statement of accounts of the Metropolitan Water Companies for 1874 has just been issued, and as early as possible we shall give our usual abstract.

Professor Tyndall commenced the evening lectures at the Royal Institution, last Friday, with a discourse "On the Optical De-"portment of the Atmosphere in Relation to the Phenomena "of Putrefaction." The learned professor claims to have discovered a fact, which we rather think has been known to housewives and maids-of-all-work from time immemorial—viz., that the atmosphere deposits dust. The special point, however, was that this dust contains particles of matter—call them "germs" if you like—which possess the power of setting up putrefaction in matters liable to undergo that process. This is not exactly a novel, but is undoubtedly an incontestable fact. But then comes the announcement of a discovery of grave importance, the mention of which may set many minds at rest. We have several times in these columns expressed our disbelief in the dissemination of the so-called zymotic diseases by "sewer "gas." The reasons for our disbelief need not be again stated. An experiment of Professor Tyndall's is conclusive on the point that a liquid, in a state of putrefaction, gives off no "germs" which can set up putrefaction. The experiment was made in this wise. In a box, into which only filtered air—that is, air perfectly freed from dust—was admitted, and every cranny of which was stuffed with cotton wool, the Professor placed, side by side, six open tubes, three containing a liquid in a state of putrefaction, and three containing a liquid precisely similar, except that no putrefaction had begun. When the box was opened, at the end of three weeks, as we understood the lecturer, it was found that no putrefaction had commenced in the three clean tubes, as we may call them. This shows that the emanations from the putrefying liquids fœtid as they may be, do not carry the "germs" which are capable of setting up putrefaction, and by parity of reasoning cannot carry the "germs" which produce zymotic disease. We hope to be able to give a fuller report of the lecture on a future occasion; but we have felt it our duty to lose no time in communicating the information given above. Perhaps we ought, in strict fairness, to mention that the professor came to the aid of the water purists, by showing that the minutest drop of a putrefying liquid conveyed to the contents of a clean tube immediately set up putrefaction.

GAS BILLS FOR 1876.

Eleven companies, now carrying on their undertakings without statutory powers, are making application for Acts of Incorporation with the usual privileges.

The *Blackrod Gas Bill* seeks power to dissolve the Blackrod Gas Company, Limited, and re-incorporate it with the usual powers. The original capital of the company is £12,000; and power is sought to raise £8000 additional, the dividend on which latter is to be limited to seven per cent., or six per cent., according as it is raised by ordinary or preference shares. It is proposed to supply fourteen-candle gas at a price not exceeding 6s. per 1000 feet.

The *Colne Valley Gas Bill* is to dissolve and re-incorporate the Colne Valley Gas Company, Limited, who have already raised and expended capital to the amount of £6396, and now seek power to increase the nominal capital to £20,000. In this instance no proposal is made to limit the dividends, except so far as they are regulated by the general Acts which are incorporated. It is proposed to supply fourteen-candle gas, the price not to exceed 4s. per 1000 feet.

The *Gorleston and Southtown Gas Bill* is to dissolve and re-incorporate the Gorleston and Southtown Gas Company, Limited. The nominal capital of the company is £25,000, of which they have raised £8000, and have borrowed £2500. The Bill proposes that the nominal capital shall remain the same in amount, and that the company shall have the usual borrowing power in respect of it. No restriction of dividend is proposed, other than that imposed by the general Acts. Twelve-candle gas is to be supplied, at a price not to exceed 6s. 6d. per 1000 feet. The district, it may be mentioned, is in Suffolk.

The *Horncastle Gaslight and Coke Company's Bill* is to incorporate that company, who have raised capital to the amount of £3000, and have expended on land and works a further sum of £8005 and upwards. The Bill proposes, that the capital of the incorporated company shall be £11,000, of which £3000 is to be called original capital, and the £8000 new capital, the dividend on which latter is to be limited to seven per cent. It is intended to supply fourteen-candle gas, at a price not to exceed 6s. 3d. per 1000 feet.

The *Kildwick Parish Gas Bill* is to incorporate a new company under the title of the Kildwick Parish Gas Company, with a capital of £3000 to be raised by the issue of ten pound shares.

The usual borrowing power in respect of the capital is prayed for. It is proposed to supply fourteen-candle gas at a maximum price of 6s. per 1000 feet.

The *Maidenhead District Gas Bill* is to incorporate the existing Maidenhead Gas Company, who have expended capital to the amount of £12,000, and have further spent on the works, out of profits applicable to dividend, the sum of £4800. The former amount is divided into 1200 shares of £10 each, which are called A shares. The latter is divided into the same number of shares, of £4 each, to be called B shares, and will be distributed *pro ratâ*, as usual. It is then proposed to raise £20,000 in £10 shares, to be called C shares. Then follows a proposal that, so long as the company charge a certain standard price, the dividends shall not exceed ten per cent. on the A shares, five per cent. on the B shares, and seven per cent. on the C shares. But, if that standard price be exceeded or reduced by more than sixpence, then for every penny or part of a penny of increase or reduction, the dividends may be increased or reduced, to the extent of one-quarter per cent. on the A and C shares, and one-eighth per cent. on the B shares. The company ask power to borrow, to the usual extent, in respect of both old and new capital. The standard price, or rather prices, are to be 5s. 6d., in or within a mile and a half of the borough of Maidenhead, and 6s. 6d. beyond that distance. Fourteen-candle gas is to be supplied. It should be added that the company seek power to purchase the Burnham Gas Company at a valuation.

The *Redcar and Coatham Gas Bill* is to incorporate the Redcar Gas Company, who have already expended capital to the amount of £18,000. The Bill fixes the capital of the incorporated company at £40,000, and proposes the usual borrowing power. Gas of fourteen-candle power is to be supplied, at a price not to exceed 6s. 6d. per 1000 feet.

The *Sevenoaks Gas Bill* is to incorporate the Sevenoaks Gas Company, who have raised capital to the amount of £15,000, and borrowed the sum of £2900. The Bill seeks authority to raise £25,000 additional capital, the dividends on which are limited to seven per cent., or six per cent., as usual. The customary borrowing power is sought, in respect of both old and new capital. Gas of fourteen-candle power is to be supplied, at a price not to exceed 6s. per 1000 feet. Authority is sought for the sale of the undertaking, at any time, to the Local Board of the district, under the provisions of the Public Health Act.

The *Slaithwaite Gas Act* is to incorporate the Slaithwaite Gaslight Company, who have already raised capital to the amount of £10,000, and borrowed on bond £2970. The company now propose to increase the nominal capital to £20,000, calling the nominal capital of the original company (£20,000, of which only one-half has been raised), "old" shares, to be entitled to ten per cent., while the additional £10,000 to be raised under the powers of this Bill is to be entitled to only seven or six per cent. as usual. The customary borrowing powers are sought. It is proposed to supply fourteen-candle gas at a price not to exceed 5s. 6d. per 1000 feet.

The *Spennymoor and Tudhoe Gas Bill* is to incorporate a gas company, having the name of the district. The capital already raised amounts to £12,500, and the Bill proposes to raise £37,500 additional, the dividends on which will be limited to seven per cent., or five per cent., according as it is issued in ordinary or preference shares. The usual borrowing powers are sought in respect of both old and new capital. Gas of fourteen-candle power is to be supplied at a price not to exceed 5s. per 1000 feet.

The *Sutton Gas Bill* is to incorporate the Sutton Gaslight and Coke Company, Limited, whose present nominal capital is £30,000, of which £20,040 10s. is paid up. This Bill is to authorize the issue of additional capital to the amount of £30,000 which, with the original, is to carry the usual borrowing power It is proposed to supply fourteen-candle gas at the maximum price of 6s. 6d. per 1000 feet.

We economize our space by remarking that, in all the above Bills, necessary provisions are made for the dissolution of the original companies, and the constitution of the incorporated, subject to all the rights and liabilities of the former. In all cases, the Gas-Works Clauses Act, 1871, is, of course, incorporated, and the companies will be required to establish a testing-place. The burner to be employed is, in every case, a Sugg's London Argand, and the pressure at which the gas is to be supplied is to be regulated as usual. In all cases, too, the companies will be required to pay interest, at the rate of five per cent. per annum, on deposits of 10s. and upwards held for six months.

Omitting here all notice of the Bills promoted by metropolitan companies, we find nine gas companies already incorporated, and possessed of statutory powers, promoting Bills, and seeking authority to raise further capital, and for other purposes. They are as follows:—

The Bill of the *British Gaslight Company, Limited*, is to enlarge the limits of their supply at Hull, and to enable them to expend £100,000 on the purchase of land, and the extension of works. Of this sum it is proposed to raise £80,000 as share capital, to be entitled to seven per cent., if issued in ordinary, or five per cent. if preference shares; and it is proposed to borrow the remaining £20,000. The company now purpose to bind themselves to supply, at Hull, fourteen-candle gas, containing not more than thirty grains of sulphur, or five grains of ammonia, per 100 feet, and perfectly free from sulphuretted hydrogen.

The Bill of the *Bristol United Gaslight Company* is simply to authorize the company to purchase additional land for the extension of works. No further capital is asked for.

The *Colney Hatch Gas Bill* is to authorize the Colney Hatch Gas Company to raise additional capital to the amount of £40,000, the dividends on which are limited to seven per cent., or six per cent., as usual. The company seek power also to issue the remainder of the capital, authorized by their Act of 1866, in preference shares. The usual borrowing power is asked in respect of both old and new capital. The company now propose to bind themselves to supply fourteen-candle gas at the maximum price of 7s. 6d. per 1000 feet.

The Bill of the *Derby Gaslight and Coke Company* seeks authority to raise additional capital, to the extent of £140,000, for the extension of works. The usual borrowing power is asked in respect of the additional capital, the dividends on which are limited as usual. Power is also sought to make arrangements with the Midland Railway for the transfer of certain lands. The company now propose to bind themselves to supply fourteen-candle gas tested as prescribed by the general Act of 1871.

The *Folkestone Gas Bill* is to authorize the Folkestone Gas Company to acquire further lands, and raise additional capital to the amount of £60,000, carrying the customary borrowing power, and limited as usual as to the rates of dividend. In this case, also, the company propose to make the supply of fourteen-candle gas compulsory, and adopt the testing clauses of the Act of 1871.

The *Rossendale Union Gas Bill* is to authorize the Rossendale Union Gas Company to raise additional capital, to the amount of £100,000, and to borrow £25,000. No limitation of dividend is proposed, other than that involved in the incorporation of the general Acts. There is nothing else of general interest in the Bill.

The *Southampton Gaslight and Coke Company's Bill* seeks to extend the limits of supply, and prays authority to raise £100,000, carrying the usual borrowing power. The dividends on the new capital are limited, as usual, to seven per cent. or six per cent., according as it is issued in ordinary or preference shares.

The *Thanet Gas Bill* is promoted by the Isle of Thanet Gas Company, who were incorporated by an Act passed in the fifth year of the reign of George IV., which Act authorized the company to raise in share capital £20,000, and, if need be, £4000 more. The company have carried on the undertaking, up to the present time, under the provisions of that Act; and, in the intervening period, have expended all the capital authorized by the Act mentioned, and £48,000 besides—out of profits, we presume. The Bill, we notice, seeks power to convert this £48,000 into what is to be called "Improvement Stock," which is to be issued as fully paid up, *pro ratâ*, to existing shareholders. The Bill further seeks power to raise additional capital, to the amount of £33,000, the dividends on which are to be limited, as usual. It proposes to borrow £12,000, in respect of the Improvement Stock, and the usual proportion of one-fourth of the new capital. The company offer to bind themselves to the supply of fourteen-candle gas, at the maximum price of 5s. 6d. per 1000 feet.

The Bill of the *Tunbridge Wells Gas Company* is to enable the company to acquire certain lands, on which to erect new works. It will be remembered that the company last year obtained authority to purchase a certain site, but it would appear that they have since discovered a more suitable situation for works, and they now seek power to dispose of the lands they had purchased, and to acquire others, described in a schedule to the Bill.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

LXXX.

THE GOVERNOR (*continued*).

Fig. 6 represents a governor partly in section, invented and recently patented by Mr. D. Bruce Peebles, of Edinburgh, which possesses some features of originality.

As shown, the holder or bell is enclosed in its case, without any communication with the atmosphere. The arrangements of the annular float, the inlet and outlet pipes, and the plug of valve suspended from the centre of the bell, are all similar to those of the

governor described in fig. 3, page 48. But here all resemblance ceases, for the plug of the valve, instead of being conical, is in the form of a dome or portion of a sphere, and to this is attached a cylindrical vessel, working in a tank, in communication with the outer tank, and supplied with water by means of the pipes at the bottom, the object of this contrivance being to prevent pulsations or oscillations of the pressure when the governor is in action.

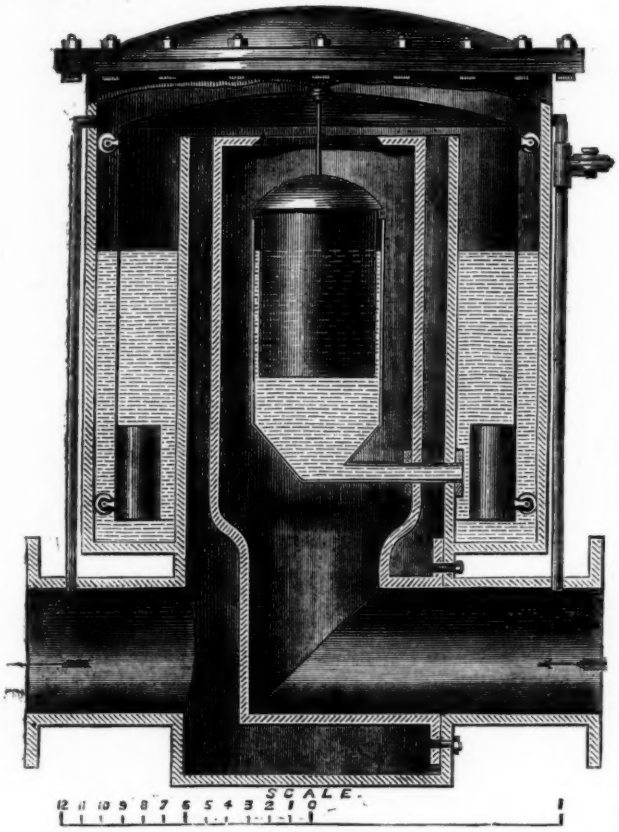

FIG. 6.

A small vertical pipe, on which is fixed an ordinary consumers dry regulator, conveys the gas from the inlet into the space on the exterior of the bell, and within the tank. Another pipe on the opposite side conducts the gas to the outlet, there being a tap on each pipe, not shown in drawing, to shut off the gas when necessary.

A peculiar feature in the instrument is that by adjusting the small regulator to the desired degree, the pressure in the space on the exterior of the bell and within the tank, is determined, and this pressure controls that given by the governor. In other words, the pressure of the governor is controlled by the small regulator, which may either be attached to, or placed some distance from the governor, but, of course, in connexion therewith.

With this apparatus the prevention of the accidental escape of gas therefrom is assured. Another point of recommendation to which its inventor attaches considerable importance, is the absence of oscillations when it is in action. Lastly, the facility of controlling the governor at a distance therefrom—as the manager, in his office, can adjust the pressure at will, although the governor may be several yards away from him—is an advantage.

There is, undoubtedly, considerable ingenuity displayed in the invention, yet, according to our opinion, the action of the apparatus is somewhat paradoxical. But against this opinion must be set the fact, which we have on creditable authority, that the instrument has been constructed as described, and with the most complete success on every account, and leaving nothing to be desired.

The rule for calculating the construction of the governor is simple, and for this purpose the weight of a cubic foot of water is the basis. This, as already stated, is 62½ lbs., or 1000 ounces. Air is about 800 times lighter than water, hence a cubic foot of the former weighs 1¼ ounce, and this fraction, on account of the impossibility of obtaining absolute accuracy in the measurement of the governor, is in practice disregarded. It follows, therefore, that a cubic foot of air possesses sufficient buoyancy to float a weight of 62½ lbs. This basis is capable of varied application, either to ascertain the float of the governor, the float of the pressure register, or even the size of the floats of wet meters. It is also applicable to determine the weight necessary to give a desired pressure on a governor of known area, and serves to ascertain the area of a holder necessary for a given weight. For facilitating these calculations, the subjoined tables, calculated upon the basis referred to, will be found useful. To employ the first table, suppose it be required to ascertain the weight necessary to give a certain pressure, say, 3-10ths of an inch, on a holder of given area, say, 20 square feet. Then 1·300, the weight per foot corresponding with the pressure, multiplied by the area, gives 26 lbs. as the weight required. Or, the weight and extra pressure being given, to find the area, then the weight, 26 lbs., divided by the number corresponding with the pressure, gives 20 feet as the area. Or, the weight and area being given, to find the pressure, then the weight, divided by the area, gives 1·300, the weight corresponding with 3-10ths pressure.

Table of the Pressure per Square Foot, corresponding with Various Columns of Water, expressed in Tenths of an Inch.

	Tenths of an Inch.		lbs.	
Column of water, or pressure . .	1/10	equal to pressure or weight of	·216	per square foot.
" "	1	" "	·433	" "
" "	2	" "	·866	" "
" "	3	" "	1·300	" "
" "	4	" "	1·733	" "
" "	5	" "	2·167	" "
" "	6	" "	2·600	" "
" "	7	" "	3·033	" "
" "	8	" "	3·466	" "
" "	9	" "	3·900	" "
" "	10	" "	4·333	" "
" "	11	" "	4·766	" "
" "	12	" "	5·200	" "

For the purpose of calculating the capacity of a float, for a holder of a given weight, the weight divided by 62½ gives the answer. Hence, if the weight of holder and appendages, as cone, &c., be 200 lbs., this divided by 62½ gives 3·2 cubic feet as the capacity of the float.

The following table is also useful for many purposes; amongst these, for ascertaining the approximative weight of a holder of known area and pressure. Thus, in a holder of 65 feet in diameter, having an area of 3318, and giving a pressure of 3 inches, the area, 3318, multiplied by the number corresponding with 3 inches pressure, gives 51,760 lbs., or rather more than 23 tons, as the weight of the holder.

Table of the Pressure per Square Foot, corresponding with Various Columns of Water, expressed in Inches.

	Inches.		lbs.	
Column of water, or pressure . .	1	equal to pressure or weight of	5·2	per square foot.
" "	2	" "	10·4	" "
" "	3	" "	15·6	" "
" "	4	" "	20·8	" "
" "	5	" "	26·0	" "
" "	6	" "	31·2	" "
" "	9	" "	46·8	" "
" "	12	" "	62·5	" "

In consequence of the facility with which gas passes through a short opening, or, as termed by the French, *mince paroi* (thin wall), as compared with its transit through a line of mains, the orifice of the valve is always smaller than the connexions. For this dimension no definite rule is observed by manufacturers, the general principle being to place a narrow flange on the top of the inlet, to which is bolted the flange of the valve. Thus for 14 inch connexions the base of the cone is about 10 inches in diameter, the other sizes being made in corresponding proportion. We believe that the base of the cone, and, consequently, the orifice in the valve, should be half the area of the connexions.

The cone, as usually constructed, is in form parabolic, as shown in diagram, and in governors of limited capacity its length is twice the diameter of its base above the flange, and should be so formed that, in rising, it closes the passage uniformly at equal distances throughout its length. To explain this, let it be supposed that the cone is 20 inches in length, and that the orifice in the flange, and, of course, the base of the cone, is 10 inches in diameter. If this be divided by horizontal lines at six equidistant points—*a*, *b*, *c*, *d*, *e*, *f*—as shown in the diagram, their various diameters and areas will be as follows, showing a difference of 13 square inches between each of the horizontal lines:—

Diameter at *a*, 10 inches; area, 78·54 square inches.
" *b*, 9¼ " " 65·09 "
" *c*, 8 5/16 " " 52·00 "
" *d*, 7 5/16 " " 39·00 "
" *e*, 5½ " " 26·00 "
" *f*, 4 1/16 " " 13·00 "
" *g*, 0 " " 0·00 "

Thus the cone rising gradually, and regularly closing the orifice of the valve, a scale of the length of the cone is affixed to the guide-bar, and so divided as to denote accurately the extent of the orifice in the valve; when, by reference to a simple table of the delivery per square inch, under variable pressures, the quantity of gas passing from the works per hour can be ascertained with a tolerable degree of accuracy at a minute's notice. Hence, according to our opinion, the area of the holder of a governor should be twenty times that of its connexions, the base of cone being one-half the area of the connexions, and its length twice its diameter; the capacity of float and weights to be ascertained as above described.

THE PRESSURE REGISTER.

The pressure register, or, as called in French, *le mouchard* (the spy), is one of the achievements of Mr. S. Crosley, by whom it was patented in 1824, and the same year was put in operation by Mr. George Lowe, at the Brick Lane station.

This instrument, like the governor, is automatic in its action, and

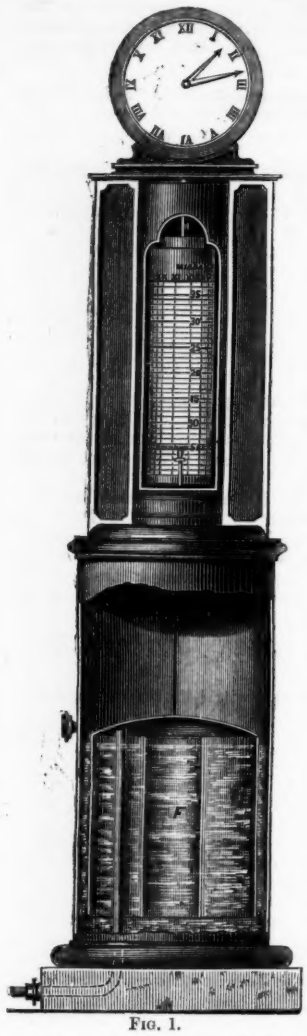

Fig. 1.

serves to record continuously the pressure in the main with which it is in communication; all that is required for the purpose being to place a new "table" on the drum daily, and to wind up the timepiece regularly. These points attended to, the pressure is faithfully recorded during the 24 hours; and even any momentary irregularity or error in the operations committed by the attendant, is noted.

The accompanying fig. 1 represents a pressure register, shown partly in section, for the purpose of explaining its action. The lower case is either of cast, or tinned wrought iron. Within this is a smaller holder, E, of about 13½ inches in diameter, corresponding with a square foot in area. This holder is guided by rollers at the bottom, and by a rod at the top, which rod passes into the chamber above, containing the vertical drum. In the centre of the holder is the float, F, of such capacity, that when the vessel is charged with water to the proper height, the holder is just buoyed or lifted from its bearing. A small pipe conveys the gas into the vessel, and, according to the pressure, so is the holder more or less elevated. At the top of the apparatus is a timepiece, and from this protrudes a rod into the chamber beneath, to which rod is connected the vertical drum, so that, by the action of the clock, it is caused to make exactly a revolution in the course of 24 hours. The middle chamber is provided with a glass door, so that the instrument can be observed continuously, the door being secured by lock and key, in order to prevent any tampering, or any suspicions of tampering, with the apparatus.

The ruled paper, or "table," shown in fig. 2, is in length exactly the same as the circumference of the drum, and has 24 numbers, with longitudinal lines agreeing with the hours of the day. There are also 36, or any other number of horizontal lines, according to the construction of the apparatus, corresponding with the pressure indicated by the respective numbers. This table is coiled on the drum, so that the words *mid* and *night* meet, and is kept in position by two india-rubber bands, as shown; and as the drum revolves by the action of the clock, each of the figures of the hours corresponds to a like figure on the dial. For the purpose of recording the pressure, there is attached to the top of the rod, in connexion with the holder, a lead pencil, pressing with a light spring against the ruled paper. Thus, on a sudden pressure being communicated to the holder, and withdrawn immediately, the rod with the pencil attached will rise and descend, making a vertical line; but, if the pressure be continued for any protracted period, the time will be indicated by the length of the horizontal line.

In some works the table is ruled with pencil, according to the desired pressure, before being attached to the drum, as represented by the dotted lines of the drawing, and at the same time the date is filled in for future reference. It then becomes the duty of the man in charge of the governor to adjust the pressure in accordance with the table. In other establishments a different system is adopted, by having pressure-sheets, on which the pressure during the various periods of the day is mentioned, and the attendant has to follow these instructions, the table of the pressure-gauge indicating the degree of accuracy observed.

On reference to fig. 2 we find, by the dotted lines, that the pressure required from shortly before midnight to 6.15 a.m. to be 10-10ths of an inch, which we may suppose necessary for supplying all the public lights. From 6.15 to 7 o'clock the pressure gradually diminished to 5-10ths, during which period we may assume the public lights were being extinguished. A pressure of 5-10ths is then continued during the day until 3 p.m., from which time it is increased gradually until 5 o'clock, when all the shops, manufactories, street-lamps, &c., are lighted; the pressure then reaches 28-10ths, and this is continued until 9.30 o'clock. At 9.45 it is reduced to 23-10ths; and again at 10.40 the pressure is gradually diminished until midnight, when sufficient only is maintained for the supply of the public lights.

Of course there are no two works which agree in all particulars respecting the hours and force of the pressure. For instance, a work may be situated in a low locality, and have to supply a hilly district, a short distance therefrom, with the mains of ample capacity. An instance of this kind exists at a continental city, where the works are about 70 feet below, and about 300 yards distant from, the entrance to the town; consequently an exhaust of 5-10ths or 6-10ths is continually maintained during the daytime on the gauge of the works, whilst the pressure to supply never exceeds 10-10ths. If, however, we reverse the circumstances, and suppose the works to be situated on an elevation, and the mains straggling and small, then a proportionately heavy pressure will be demanded. An example of this kind existed at the old works of Belleville, at Paris, where the gas had to descend about 150 feet to supply a portion of the district. It may be also mentioned, as an example of the loss of pressure by

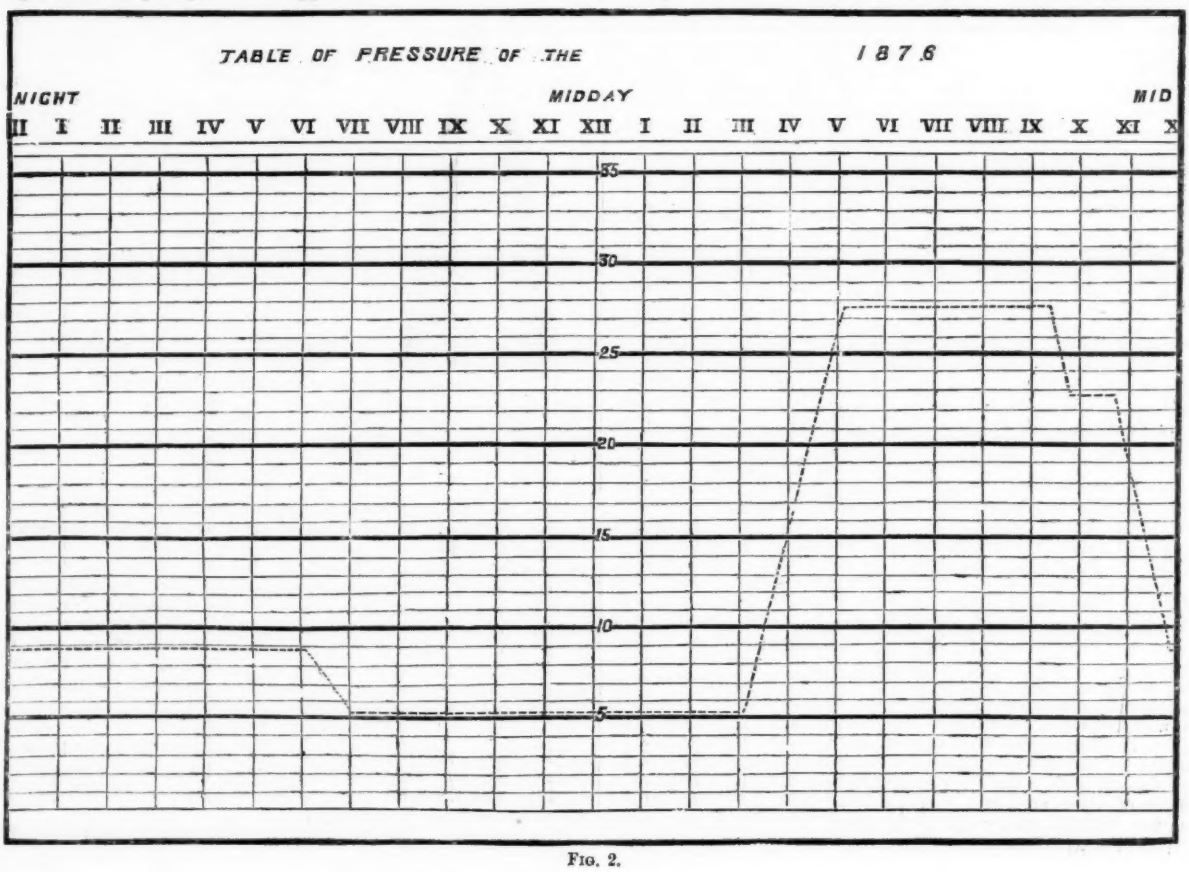

Fig. 2.

mains of insufficient capacity, that at a metropolitan work, some years ago, a 6-inch main, of about 2½ miles long, was employed to supply a district, and although at the works the pressure was five inches, yet at the end of the district, during the heavy lighting, there was not 1-10th pressure. Let it be said, however, that this occurred before the importance of large mains was understood, and perhaps when directors of gas companies were afraid to invest capital for any augmentation.

Another description of pressure register is the invention of the late Mr. A. Wright, and is represented in fig. 3. This differs in several points from that already described, and consists of a shallow external case, having an annular division concentric thereto. Within the central chamber formed by the division, is placed the float, to which is attached the rod with its corresponding pencil. In the centre is a timepiece, but instead of a dial it has a ruled paper attached thereto, with the twenty-four hours of the day indicated thereon, the concentric lines agreeing with the various pressures.

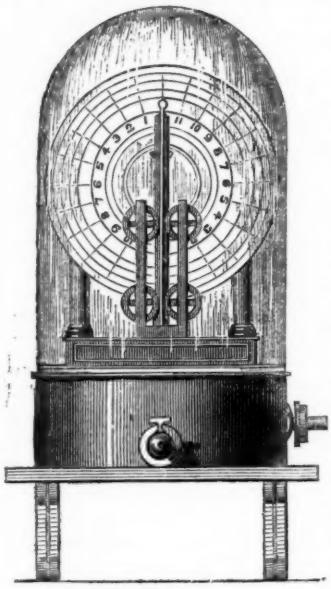

Fig. 3.

The action of the instrument is simple, for the gas being admitted into the case, depresses the water therein, and elevates that in the central vessel, so raising the float according to the extent of the pressure, and marking this on the ruled paper. This apparatus has the recommendation of being about half the price of the other; it is also more compact; on the other hand, there is considerable risk of breakage of the glass shade, which is required to be removed daily for the purpose of exchanging the ruled papers.

(To be continued.)

Correspondence.

GAS-EXHAUSTERS.

Sir,—Your correspondent, Mr. Dunlop, reminds me that I promised to point out what seems to me a fallacy in his reasoning respecting exhaustion, set forth in his letter published in your issue of the 26th of October.

Premising that I have in view only what I presume is the main object of exhaustion—viz., to save gas by reducing leakage from the retorts—I beg leave to point out that the amount of that leakage depends on the *difference* between the pressure in the interior and on the exterior of the retorts. Speaking in a general sense, the leakage will be great when that *difference* is great, and small when that is small. If the difference is the same—in other words, if the same vacuum is maintained in the hydraulic main, and other things are equal, exhaustion will be as effective, for its main purpose, with a low as with a high barometer. Unless I misunderstand Mr. Dunlop, the fallacy lies in his dealing with *absolute* pressures, as if they greatly affected the result, whereas it is only *differential* pressures that are practically important.

In this Mr. Tysoe seems to agree with me (see the fifth and sixth paragraphs of his letter of the 3rd of December), in which, as I read them, he has anticipated what I have here written.

The ruinous leakage that at once attracts attention in works with any considerable pressure, whenever a stoppage of the exhausters occurs, and which gives every stoker ocular demonstration of the great utility of exhaustion, is neither represented nor, speaking strictly, is it *directly* caused by the addition of about, say, *three* per cent. to the absolute pressure in the retort. That, indeed, is a cause, but a cause secondary to this is the important one—viz., the addition of about, say, *three hundred* per cent. to the differential pressure.

As the other advantages of exhaustion, real and supposed, have been so fully discussed by your other correspondents, and as the prevention of leakage is quite enough to justify the general use of exhausters, I need not now enter further on the subject.

Linacre, Jan. 21, 1876. William Cleland.

THE DEPOSIT OF CARBON IN RETORTS.

Sir,—The correspondence in the Journal, on the formation of carbon in retorts, has been very interesting. It is a subject of great importance to the gas manager.

To show how pressure has to do with it, I should like to state that, in the autumn of 1874, I erected a new bench, containing 42 15-inch round clay retorts, each length of hydraulic main being isolated, and having a square valve on the outlet, so that the dip (if necessary) could be regulated to any depth required.

The dip-pipes were set at 2½ inches. The pull, through using Beale's hydraulic regulator, was uniformly kept at 28-10ths. The result, as a matter of course, was, that the pressure on the retorts was *nil*, and the formation of carbon nearly so,—in fact, when the retorts were let down in the spring, it was almost imperceptible, and during the time they were in operation (some six months) they required not the slightest attention. There were other retorts at work, in which there was about 3 inches pressure, and notwithstanding that the exhauster worked regularly, the carbon had to be burnt or punched off in the best way we could about every three weeks, thereby injuring the retorts, stopping the work, and causing the loss of the greater portion of the gas from the coals with which they were afterwards first charged.

Apart from all scientific considerations, this clearly shows what is the cause and what the remedy.

I may also mention that in a small works, about which I am occasionally consulted, iron retorts are used; the pressure upon them is about 4 inches, and, although they are kept at a good working heat, I have never seen any carbon on them.

This last fact, taken in conjunction with what I have before stated, shows clearly the difference between iron and clay retorts with regard to the formation of carbon. James Eldridge.

Gas-Works, Richmond, Surrey, Jan. 20, 1876.

Sir,—I should not have taken the trouble to write on this subject, but when several correspondents are trying to murder an old friend, that none of us can do without, I think it is time some one should say a few words on his behalf. I would ask these gentlemen what they can do without the formation of carbon in clay retorts? Can any of our clever engineers or chemists provide a substitute for it? If so, let us know what it is, for assuredly we cannot dispense with the deposit of carbon until something is found to keep clay retorts tight. I admit it would be very nice if we could say to our friend carbon, "Look after me, and stop up my cracks, and keep me in good working order; but I cannot allow you to intrude inside, because you are a nuisance to me, and a great expense;" but this we are not yet able to do.

Every engineer or manager knows how to clean the back end of retorts from carbon; but, for the information of managers of small works, where they are compelled to work with single-end retorts, I may mention that the following plan I have found never failed, in one single instance, in scurfing retorts. What should be done last is generally done first—that is, to begin to chip at the mouthpiece. This should be left until the retort is properly scurfed, and stopped ready to charge—then chip your mouthpiece. By this means you will avoid a leaky joint round the mouthpiece. The next time you require to scurf the retort, when you charge the retort give the stoker orders to tail the retort tight with coals—say, 18 inches—and let the coke remain. The carbon will thus waste away from behind, and leave the carbon at the end quite loose, and your retort will be as clean as ever. I am not writing anything new, as I have practised it, and seen the effect, for the last 20 years. You will find no difficulty in making your stokers understand what you mean by tailing the retort, for they all know how to do this effectually, especially when they disagree one with another. Trusting this may be of some service to those who do not happen to know how to deal with the so-called enemy (I must still call him friend, although I admit he is a very troublesome one), I will only add that I am afraid I have, like others, taken up too much of your valuable space; but, if you will kindly insert this, I promise faithfully I will trouble you no more on the subject, but patiently wait for the substitute.

R. Good, Manager.

Carshalton Gas-Works, Surrey, Jan. 20, 1876.

THE PROPOSED AMALGAMATION.

Sir,—Permit me, by means of your very valuable Journal, to request my co-proprietors of the Imperial Gas Company carefully to peruse the admirable address of the chairman of the meeting held on the 13th of August, and published in your issue of the 17th idem. It is most clear and exhaustive.

The directors at that time were resolved to use every endeavour to defeat the bill of the Metropolitan Board of Works and Corporation of London, objecting in their own bill to a sliding scale, and they urged the proprietors to use all the influence they possessed to support them. Three months afterwards a special meeting of shareholders was called to listen to a scheme proposed by the directors for amalgamating with the Chartered Company, about which no information had been given, until the meeting assembled. So sudden and important a resolve was, and is, incomprehensible. It is important the proprietors should consider that if amalgamation takes place, their property will be regulated by the Act of the Chartered Company, which gives no power to form a reserve-fund, such as the Imperial Act does, and on which fund it has repeatedly been necessary to draw, to make up the 10 and 7 per cent. dividends *sanctioned by Parliament*. The bill of the Chartered Company adopts the sliding scale principle. If modifications to the amalgamation scheme are made by the Board of Trade, which the proprietors of the Imperial will not agree to, the directors will find themselves in the dilemma of having advocated the sliding scale by amalgamation, and going to Parliament with their own bill, objecting to it. The proposed measure is of immense importance to the Imperial gas proprietors, and deserves their serious consideration.

A Proprietor for Many Years.

GOVERNORS TO METER LAMPS.

Sir,—In the present day, when it is considered unsafe to believe anything we hear, and, in fact, only one-half of what we see, it is difficult, among the many sayings and sights, to know really what is correct and reliable. Proof, is the cry; and even that at times renders "confusion worse confounded."

With reference to Mr. Key's letter on the above subject, in your issue of the 4th of January, I am sure I only speak the words of many of my brother-managers when I say I am at a loss to understand it.

Mr. Key seems to ignore the duties of that beautiful little instrument so largely adopted in its many forms—the lamp regulator; and I would ask Mr. Key, if it cannot overcome the reduction of pressure, following the use of a meter (which we will say at the most is 2-10ths, and with wet meters less), how can it succeed with the ever-varying pressure in our gas-mains? and what advantage has it over a common cock or well-made burner? Either of the two would do equally as well if such adjustment as he notes were necessary.

As this is a subject of the greatest importance to all who have adopted the average meter system to public lamps, I shall be glad if some one, more able than myself, would follow it up.

I must confess I have made no allowance for meter lamps other than regulators; and, as far as the system has wrought, it has, in every case

where adopted, been so far a success. I am of opinion that any great variation in the consumption of lamps, where good regulators are used, is due to other causes than pressure; bad or dirty jets not being the least of them.

As an example of two lamps burning gas under very different circumstances, as far as pressure is concerned, I give the following:—

	Consumed in Oct.	Nov.	Dec.
No. 1, 3 feet above works	1000 . .	1100 . .	2400
No. 2, 130 „ „	1000 . .	1100 . .	2450

each lamp having a 3-light meter, and a patent regulator.

Further, in testing one of the above regulators, I found it pass

At 19-10ths pressure 4·1 cubic feet in one hour.
„ 12-10ths „ 4·1 „ „
„ 10-10ths „ 4·15 „ „

The above I consider very convincing, and strengthens my faith in lamp-regulators. Still, I hope some one will confirm what I say, by adding their testimony to the cause, or give more convincing proof to the contrary; but by all means give us light! On such a subject it is very necessary, and will be very acceptable. THOS. D. HALL.

Redruth, January, 1876.

MALAM'S PROCESS OF GAS-MAKING.

SIR,—I am instructed to reply to Mr. Malam's communication which appears in last week's issue of your valuable JOURNAL. Permit me, in the first place, to state that my brief reply to "Gascon" was not intended to open a discussion that has often been adjourned until more reliable experiments were made. Mr. Malam's letter has induced my committee to give your readers the correspondence (beginning where Mr. Malam finished), anent their endeavour "to get Mr. Malam to allow them to test his process of gas-making in Dumfries Gas-Works, in compliance with the instructions they received at the Association's half-yearly meeting, held in Stirling last September," and allow them to judge whether my reply to "Gascon" was "calculated to mislead, and how far it is in accordance with fact."

Dear Sir,—Yesterday I laid before the sub-committee of the West of Scotland Association of Gas Managers, appointed to make experiments with your process at Dumfries, your reply to my note of the 27th ult., expressing their opinions as to the best methods of arriving at a fair result. I am desired by them to intimate to you that they very much regret that you do not coincide with their views, and that they are surprised that you should ask them at the Association's expense to supply the coal necessary to make the experiments. And, further, that you should think there would be anything unfair in allowing them the use of your plant, so as to convert the whole into the ordinary process of gas-making, by removing the incandescent coke, and stopping the water from the ascension-pipes, these two being the essentials to the working of your process.

As you have frequently at our meetings expressed your willingness to give every facility to make the necessary experiments, the committee hope you will reconsider the matter, and see your way to kindly allow them the privilege of visiting your works, and making the experiments as they proposed; employing the coal from which you are at present making the gas for supplying the town of Dumfries, as they do not doubt you will in all liklihood be using the coal best adapted for your process, and they will agree to take the same coal, and use it in your plant, modified as previously described to the ordinary method of gas manufacture. (Signed) JAMES M'GILCHRIST, Secretary.

A. Malam, Esq., Dumfries.

Dear Sir,—Your favour of the 5th inst. to hand, and in reply have to state that I am, as I have always been, most anxious to afford every facility for a fair test being made of my process, but am still of opinion that the conditions, as indicated in my letter of the 27th of September, are the fairest that could possibly be laid down. I repeat, that my apparatus cannot be converted into ordinary plant in the off-hand manner proposed; indeed, the size and construction of the retorts preclude the possibility of doing so. If a reliable test is desired, it must be conducted in such a manner as neither to take nor give advantage, nor to leave the result open to doubt of any kind. The supply of coal required is not a serious matter, and rather than that should stand in the way I will provide the coal at my own expense.

(Signed) A. MALAM.

James M'Gilchrist, Esq., Secretary of West of Scotland Gas Managers Association.

Dear Sir,—Yours of the 8th inst. was laid before the sub-committee to-day, who have instructed me to intimate to you that they very much regret you think there would be anything unfair to your process in making the experiments in the way they proposed, as Mr. Nelson (your agent) and our association at the Stirling meeting agreed to have the experiments made in the way proposed. The sub-committee do not see their way to deviate from said proposal, and they now desire me to ask you if you will give them the privilege of visiting your works, to make such experiments as may enable them to report on your process of gas-making to their Association. A reply, after reading report of our Stirling meeting, in GAS JOURNAL will oblige.

A. Malam, Esq., Dumfries. (Signed) JAMES M'GILCHRIST.

Dear Sir,—In reply to your favour of the 18th inst., I must again refer you to my letter of the 27th of September, as containing (except in so far as supplying the coal is concerned) the conditions upon which I am willing that the committee should test my process, nor can I understand why the committee should have any objections thereto. Permit me also to refer you to my letter of the 8th of October, to which I scarcely think it is necessary to add one word. I am, as I have already stated, prepared to give the committee every facility for testing my process, provided such tests are conducted in such a manner as to place the results beyond dispute; but, as this could not be accomplished by the means which the committee propose, and would only lead to further speculative discussion, such experiments would be of no value. I must, therefore, decline consenting to the method by which the committee propose to conduct the tests. (Signed) A. MALAM.

J. M'Gilchrist, Esq., Secretary, West of Scotland Gas Managers Association.

Dear Sir,—I laid yours of the 22nd before the sub-committee. I am instructed to let you know that they will not test your process of gas making, unless you allow them to do so in the manner they at first proposed.

A. Malam, Esq., Dumfries. (Signed) JAMES M'GILCHRIST.

The JOURNAL OF GAS LIGHTING referred to a correspondence in the issue of Oct. 19, p. 586.

I may state that the "committee" are still willing to test Mr. Malam's patent process, if he allows them to make experiments in the way proposed—a way that, in their opinion, would "neither give nor take advantage," and which would "place the results beyond dispute." Mr. Smith, of Aberdeen, tested Mr. Malam's process at Dumfries, and compared the results with his own working. We all know how unsatisfactory Mr. Malam considered that report, and the "speculative discussion" it caused. Mr. Malam having no patent for the setting or sizes of his retorts, your readers will understand the simplicity of converting this patent process into the ordinary one, by removing the incandescent coke, and stopping the water from the ascension-pipes, these two being the essentials to the working of his process, and that with the gas by both processes passing through the same meter and holder, and being tested by the same photometer, burner, and candle, the value of the patent could be tested in a most satisfactory way.

JAMES M'GILCHRIST, Secretary,
West of Scotland Association of Gas Managers.

Gas-Works, Dumbarton, January, 1876.

GUARANTEE *VERSUS* DEPOSIT.

SIR,—The result of my experience, extending over some years, entirely accords with your recent observations on this matter.

A cash deposit is preferable to any other security for gas to be consumed, for many reasons—every year it becomes of greater value, whilst a guarantee becomes less so, and this is important, as with new consumers the gas account is likely also to become larger; again, the consumer having a deposit to his credit (with interest added on withdrawal) is sure to give prompt notice of any intended removal or other change affecting the account. A guarantee may become a dead letter at any moment, and perhaps, when a considerable amount may be owing, its renewal is a very difficult and troublesome matter, therefore often waived, and the company left with no security at all; if it has to be enforced, it may prove valueless, and only add costs to the debt; and if the company recover their money on it, they generally make an enemy, and of one possibly who, but for that, would have remained a good friend.

Jan. 19, 1876. NORWOOD EARLE.

Parliamentary Intelligence.

GAS AND WATER BILLS, 1876.

TUESDAY, JAN. 18.

The Examiners (Messrs. Frere and Robinson) commenced their sittings this day, and declared the Standing Orders had been complied with in respect of the following unopposed petitions for Private Bills:—Ramsgate Local Board; Lancaster Water and Improvement; Ramsgate Water; Stafford Borough Extension; Llandudno Improvement; Colne Valley Gas.

Four Memorialists petitioned against the Stockton and Middlesbrough Corporation Water Bill, and the Examiners reserved their decision till the following day.

WEDNESDAY, JAN. 19.

The Standing Orders were found by the Examiners to have been complied with in the following unopposed cases:—Rossendale Union Gas; Paisley Water; Cleveland Water; Walsall Gas Purchase and Borough Extension.

Further allegations were sustained against the Stockton and Middlesbrough Corporations Water Bill, and the Standing Orders were declared not to have been complied with.

THURSDAY, JAN. 20.

The Standing Orders have been complied with in respect of the following unopposed petitions:—Kildwick Parish Gas; Folkestone Gas; Whitehaven Harbour and Town Improvement; Gaslight and Coke Company; Galashiels Municipal Extension Police and Water; South Hants Water.

In the case of the Thanet Gas Bill (opposed), the Examiners reserved their decision.

Some allegations of non-compliance were inquired into in the case of the Padiham and Hapton Local Board Bill, and the consideration was adjourned till next day.

FRIDAY, JAN. 21.

The following unopposed petitions for Bills passed the Examiners of Standing Orders:—Southwark and Vauxhall Water; Wakefield Water; Halifax Water and Gas Extension; Stockton and Middlesbrough Water; Maidenhead District Gas.

The Thanet Gas and Padiham and Hapton Local Board Bills, adjourned from the previous day, were declared to have duly complied with the Standing Orders, none of the allegations against them being sustainable.

SATURDAY, JAN. 22.

A memorial, complaining of non-compliance with the Standing Orders, in the case of the Rosstrevor Improvement Bill, has been presented from the Carlingford Lough Harbour Improvement Commissioners.

A CHRISTMAS APPEAL.—For the widow and family of the gas manager, whose case we recently submitted to our readers, we now thankfully announce the receipt of the following contributions:—

Sums already acknowledged	£51 5 6
Mr. S. Cross	0 5 0
J. H.	0 5 0
Mr. J. Morton	0 2 6
Mr. W. Bates	0 10 6
Mr. W. J. Moon	0 10 0
Mr. R. Fish	1 1 0

PRESTON GAS COMPANY.—The report of the directors of this company presented to the meeting of shareholders on the 17th inst., stated that notwithstanding the unfavourable state of trade in the district, a sensible increase had taken place in the consumption of gas, the income from that source and meter-rents in the past year, 1875, being £47,053 2s. 10½d., whereas in 1874 it was £43,751 3s. 3½d. The profits for the past year enabled the directors to recommend that the usual dividend of 10 per cent. on stock A, and 7 per cent. on stock B, be declared. As the cannel and coal contract with the Wigan Coal and Iron Company expired in July last, the directors had entered into an arrangement with the same company for a temporary supply. As, however, the deliveries of cannel had fallen into arrear, and that arrear was now being delivered, the increased expenditure for fuel, though considerable, was not so great as it would otherwise have been. In view of the expiration of the existing arrangement for the supply of coal and cannel, the directors felt that it was only due to the Wigan Coal and Iron Company to give expression to their high appreciation of the very honourable and punctual manner in which the company had carried out a contract which could not fail to have been to them a source of considerable and long-continued loss. It would shortly be the duty of the directors to take steps for effecting a new contract for these necessaries. They feared that it would not be possible to effect this except at enhanced rates. A reduction had taken place in the income for the sale of coke, owing wholly to the reduced value of that article.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

FRIDAY, JAN. 14.

(*Before Vice-Chancellor* BACON.)

PATTERSON *v.* THE GASLIGHT AND COKE COMPANY.

Mr. SOUTHGATE, continuing his argument, said the next letter in point of date was dated the 19th of February, 1872, from Mr. Phillips to Dr. Odling, stating that the returns made of the official testings were causing the directors much uneasiness, and all efforts to correct them had been baffled. It was said that inasmuch as, according to the plaintiff's version, his patent was a certainty, efforts which had been baffled could not have been made in any manner under his patent. He had pointed out to his lordship the state of the Beckton works from time to time; and it would be for the court to deal with the suggestion of the defendants that that accounted, till some time in 1872, for very varying results, and in addition it could not be repeated too often, there was no certainty even now. It appeared from the letter of the plaintiff that it was the plaintiff who suggested that the company should apply to Dr. Letheby and Dr. Odling. What an extraordinary thing that was. The plaintiff, according to his statement, had an invention which he had matured at Christmas. He said the first germ occurred in 1870, a thing which would give certainty, and yet he suggested that they should send for Dr. Letheby and Dr. Odling before the report was produced, which would show a very high average, in order that suggestions might be made. How was that consistent with the fact that the plaintiff believed at the time he had an invention which would certainly get rid of the difficulty? Was it not plain that up to that time he was acting honestly, doing his duty as one of the gas referees, making inquiries of one of the officers of the company, endeavouring to get rid of the difficulty? Dr. Odling wrote to say that trustworthy knowledge on the subject was comparatively small. That was because he knew difficulties which never occurred to the plaintiff. The minute compounds of sulphur, until Dr. Letheby called attention to them, had never occupied the attention of gas managers at all. But the knowledge which the plaintiff got from the different officers of the company showed they knew that sulphide of calcium would get rid of the sulphur impurities. Dr. Letheby took a different view of his duty. He did not think, being an officer of the Government, that he was at liberty, without the consent of the Government, to take out of the pockets of the company a royalty for anything he discovered whilst so employed. He says he could not go without the permission of the Board of Trade, which was afterwards obtained. Then there was a letter from Mr. Trewby, which was of considerable importance, showing beyond all doubt that Mr. Trewby knew what the plaintiff supposed he had found out, and yet Mr. Trewby, with his knowledge up to February, 1872, had not been able to control the sulphur impurities at Beckton. Therefore, if the effect of that knowledge was certainty of control, they had the conclusion that the Beckton works were not in a state of perfection up to that time. The referees letter of the 8th of February had been forwarded to Mr. Trewby, speaking of the sulphur at Beckton being excessive in quantity, and asking whether the company had done all they could to keep it down, and for a statement of what had been done to remedy the defects. Unless his lordship were prepared not only to impute to Mr. Trewby actual perjury, but a design to to take away from the plaintiff, on the 19th of February, an invention which did not exist until the 9th of March, that letter was conclusive. Mr. Trewby said his attention had been given to the subject since the opening of the works, and numerous experiments had been made to elucidate the subject, showing that in the first week of September, 1871, they got down as low as 17 grains per 100 feet, and then without any change in the mode of manufacture the sulphur continued to rise, so that the result he arrived at was that it was caused by the retorts, which were not equally heated. Then as to the coals he was using, they contained more than the average amount of sulphur, so that the sulphide of calcium was no sooner formed, and in a fit state to take out the bisulphide, than the carbonic acid took its place. Where was the novelty, so far as Mr. Trewby was concerned, of the principle that sulphide of calcium would take out the sulphide of carbon, and that the carbonic acid would destroy the sulphide of carbon, so that it would no longer act? Dr. Letheby and Dr. Odling both declared in their cross-examination, as did the other witnesses in their affidavits, that supposing the statement in the letter to be true, that was the mode described in the plaintiff's patent. Mr. Trewby, in his affidavit, said that he had made the alterations mentioned in the letter. The plaintiff admitted, in cross-examination, that if Mr. Trewby did what he stated in his letter of the 19th of February, it was his patent. Therefore, the question was whether, on the 19th of February, Mr. Trewby wrote a falsehood to defeat a patent taken out on the 19th of March. Dr. Odling went down on the 24th of February, and on that occasion he saw Mr. Trewby, who fully informed him of the methods by which he was working the lime purifiers, and he distinctly remembered that on one occasion tests were in use to detect carbonic acid in the gas passing through the lime purifiers. The plaintiff admitted that if it was done at that time, it could not be in consequence of any information obtained from him, because the report was not issued till a day or two afterwards, and the patent, of course, nobody had seen. Then there was a statement of the plaintiff as to something which took place at an interview with Mr. Trewby on the 8th of March, as to what Mr. Trewby said, that on one occasion in March, 1872, just as he was leaving the plaintiff, the plaintiff asked him whether he would be surprised to hear that he had taken out a patent for carbonic acid, and added that his object in taking out the patent was not to make money, but to show some people what the referees were capable of doing; but he did not give to Mr. Trewby the slightest insight into what he had patented. Having read certain portions of the provisional specifications of Mann and the plaintiff, the learned counsel said the construction of the specification was for the court; but, reading the two documents, could there be any doubt that the two gentlemen might have put such a complete specification on the file, as to the principle which they claimed, in identically the same words, and there would have been no variation between them. It was satisfactory when an imputation had been made, and when they were told that statements were incredible, to be able to put the finger upon a document, *ante litem motam*, showing conclusively the state of Mr. Trewby's knowledge long before the plaintiff's patent. Mr. Evans, in his affidavit, said that in compliance with the request of the referees, the defendant company requested Dr. Letheby to inspect the works, and on March 11, 1872, Dr. Letheby did so, in company with himself. Dr. Letheby suggested that the company were taking out too much ammonia from the gas previous to the lime process, and that the purifiers should be discharged earlier. Dr. Letheby said he inspected the defendants works, and found there were four purifiers in a set, the first two being for carbonic acid, and the last two for sulphur; and, in fact, the process of the plaintiff, described in his provisional specification, was strictly followed. The plaintiff admitted, in cross-examination, that nobody could have known anything about his patent on the 11th of March, but he said the statements of Mr. Trewby and Dr. Letheby were totally irreconcilable, adding, however, that he could not doubt what Dr. Letheby had said. Dr. Letheby's report made certain suggestions, which were afterwards carried out. On the 20th of March Mr. Harris made an alteration at Bow as to the quantity of lime, and as to slaking it with less water. On the 21st of March, Mr. Phillips, the secretary of the company, wrote a letter to Dr. Letheby, in which he said that at Beckton Mr. Trewby was already acting upon his suggestions with a beneficial result, obtained, however, at a most alarming cost. The counsel for the plaintiff seemed to think that Mr. Trewby was going to charge all the purifiers at once; but that was not the case, because he only charged the first one. On the 22nd of March Dr. Letheby wrote to Mr. Phillips, saying that the heat ought not to be great. Then there was a letter of the 23rd of March, 1872. In consequence of this extra expense, Mr. Trewby, at Mr. Phillips's request, wrote to Dr. Letheby, telling him what they were doing in the way of reducing the amount of sulphur in the gas, and saying that they worked the purifiers in the same way as was done at Bow, having three at work and one off; and that this reduced the sulphur to some extent, but that there was a large amount of carbonic acid after the gas passed the scrubbers, which was remedied after the condensers were put in operation. He said he had commenced quite a new plan, working two purifiers in a set, the first two for carbonic acid, and the last two for sulphur, charging the first purifier as soon as it showed carbonic acid. A great deal was attempted to be made of the words, "quite a new plan," but the new plan adopted on the 18th of February was that they ceased to work in the old way of working the purifiers. The plaintiff, upon cross-examination, admitted that the process described by Mr. Trewby was one of the modes described in his patent under the first head; but he said he knew Mr. Trewby did not do it from the workings of his purifiers, and asked the court for some reason which operated upon his mind to come to the conclusion that those statements were not accurate. He would now call attention to a letter of the 27th of March, which was not mentioned by the plaintiff's counsel at all, from the plaintiff to Mr. Phillips, the secretary of the company, saying that they had sent in their report on the previous day, because it could not be kept back any longer, and offering to forward a copy on the day following. It contained this passage: "That the suggestions in the report have been communicated to Mr. Trewby and others months ago." It seemed to him it was hopelessly and utterly inexplicable. If, by any wonderful ingenuity, there was an explanation of that statement consistent with the validity of the plaintiff's patent, he hoped his lordship would allow the defendants counsel to say a word or two after the explanation had been given, it not having been furnished in the opening of the case. Mr. Trewby was the servant of the defendant company, engaged for them in making experiments, and in completing enormous gas-works. One of the public officers, who had a right to go over the works, question the officers, and obtain all sorts of information, made a suggestion to Mr. Trewby. He assumed the plaintiff would try and get over it by saying it was a suggestion made in confidence. In confidence! A man in that capacity, who had got from other people information as to the mode of getting over a difficulty, told the defendants officer it could be done in such and such a way, and that servant, at an enormous expense, adopted the suggestion and carried it out—not by mere experiment, not by something done in his laboratory, not by a machine handed over to a friend to try, but in order that it might be carried out upon a working scale, at an enormous expense. What possibility was there for anybody to argue that the suggestion was made to Mr. Trewby in confidence? The truth was that, as between Mr. Trewby and the plaintiff, Mr. Trewby must have smiled when the plaintiff was communicating to him as his wonderful discovery things which Mr. Trewby had known for years. When the plaintiff was cross-examined upon that, he said he had not communicated the subject of his patent before he drew up the report of the 31st of January, that it was not true that months before the 27th of March all the suggestions contained in the report had been communicated to Mr. Trewby and others, but all the suggestions about carbonic acid. When asked to explain that, he said all the causes of the failure had been communicated, but the lime process was not; therefore, that the statement in the letter must have been a slip. Afterwards being asked if the statement was untrue, he said "Well, say so if you like." He (the learned counsel) did not like to say it was untrue, but he was compelled to do so. Then there was Dr. Odling's report on the 28th of March. Working out the system of inferences adopted by the plaintiff, his counsel commented upon the opening paragraph, in which it was said that Dr. Odling felt some difficulty in reporting upon the subject, on account of the very small amount of positive knowledge existing as to the conditions under which gas became charged with sulphur, and as to the means by which it was capable of being removed. Could a passage like that have the slightest effect in invalidating the statement that there was nothing whatever novel in the plaintiff's invention. In March Mr. Evans and Mr. Trewby proved that they discovered that the purifiers had got distorted. They spoke to the fact of the works necessary to be done to put the distortion right, nevertheless the court was asked to disbelieve those gentlemen, because the plaintiff, and some of his witnesses in reply, did not understand, and did not believe that such a thing could have occurred, although not one of them saw it. The plaintiff's counsel said the purifier could not be emptied without it being noticed. But Mr. Trewby could not be everywhere, and he did not know of the distortion of the purifiers until he said he knew it. And if his friend's case depended upon the ignorance of Mr. Trewby, he wished them joy of their case. Then there was the fact as to the decrease in impurities occurring in May and June, 1872. One thing accounting for that was the lengthening of the days, and the quantity of work to be done not being so much. The plaintiff had set out a table showing that fact, but he began with the month of October, 1871, because in the month of September, 1871, the average at Beckton was very low, which he kept back. There was only such alteration in the works at Bow as a practical gas manager would try. Mr. Harris had found out that for some reason or other, putting a very small quantity of water to slake the lime, affected a very considerable improvement. That was done in the month of March, or a little later, in 1872. The check purifiers were completed on the 12th of May, 1872, and they immediately became active and very important, because they enabled Mr. Trewby to do what he could not hitherto do, namely, to increase the charges of lime in other purifying-houses, to put lime into a purifier which previously held oxide of iron. On the 23rd of April a letter was written, which it was said defined the duties of the referees; but which in fact was preliminary to a civil dismissal. It was said they were not told that one of the duties of the referees was to invent anything. Nobody supposed they did. But the Board of Trade were not told that the plaintiff had got a patent, and therefore, what they did not tell him could not have anything to do with the matter. Up to the 3rd of June the plaintiff continued reporting to the Board of Trade, that the referees, paid a salary of £700 each, had made the suggestion in the interest of the public, and never said he had got a patent of which he intended the public to have the benefit, but the gas companies must pay a royalty for using it. It must be borne in mind also that anything beyond a certain dividend to the shareholders, paid by way of royalty, would come, in fact, out of the pockets of the public. It was from this date, and not earlier, that Dr. Letheby's report showed reductions. The report showed that the impurities at Beckton and North Woolwich, at the commencement of May, 1872, were 39·99, and on the 31st of May only 11·9; and in June the average, which before the check purifiers were completed had been 39·99, fell to 18·64. The plaintiff accounted for this diminution by saying the company used his invention, but the reason was that the Beckton works at that time had been completed by the addition of the check purifiers. The returns also showed coincident reductions at the Bow works after Mr. Harris had made his alterations in slaking the lime. Then it was said that that was accounted for by the alteration in the times of changing the purifiers, but the book in which Mr. Trewby entered the various times of changing the purifiers was in evidence, and his friends were at liberty to refer to it. A reference to it would show, beyond all doubt, that there was no change whatever in the mode of dealing with the purifiers, and that matters went on exactly in the same way as they had from the 12th of May, when Mr. Trewby

made his alteration. There was really nothing whatever to support the insinuation of the plaintiff, that the company were using his patent. On the 31st of July the referees fixed the maximum at 15 grains, and from that time he admitted the managers of the company had succeeded in working within the limit. If the patent was a good patent, he did not deny that the erection of the carbonate of lime purifier outside the house was an infringement, but coupled with that admission, he asserted that the process had been in use for some years at Bow.

The VICE-CHANCELLOR: You admit you have infringed, if the patent is good; but you deny that it is good.

Mr. SOUTHGATE: Just so. Then, on the 16th of December, the plaintiff wrote to the company, suggesting that he had a patent, and asking them to pay a royalty. On the 27th, the company replied that they could not acknowledge the claim in any way. In the following February the plaintiff wrote, threatening them with law proceedings. The company replied that they would leave him to take his own course, and the present suit was the result. He had taken his lordship chronologically through the facts of the case, and ventured to think that, with the light he had thrown upon it, it stood in a very different position to that in which it did when first opened. He would now proceed to mention, as shortly as possible, the various points which occurred to him against the patent. His first point was that the plaintiff was not the original inventor. He was a public officer, appointed under an Act of Parliament, authorized to make every inquiry—the companies being bound to give him every information, in order to ascertain all the particulars of the sulphur impurity, and authorized, when he had so ascertained it, to fix a maximum, under which the companies were to work, subject to the payment of heavy penalties if they did not. They had the undoubted fact that the company wrote letters, in which they stated their willingness to allow him to make every experiment; and so the evidence of Mr. Trewby showed what was done from time to time. It was true that the plaintiff and Mr. Trewby did not quite agree in this respect, and it would be for his lordship to decide between them. He did not impute to the plaintiff that he intended at all times to be guilty of fraud—using that term in the sense in which it was understood in a court of law—in obtaining information from the officers of the company holding the position of referee, and having represented to the Board of Trade that it was the suggestion of the referees, made in the execution of their office, but having entirely concealed from them the fact that he had obtained a patent which he intended to force against the company, he tried to get the thin end of the wedge in by asking for a small royalty, though without success. The whole of the plaintiff's story must be taken together, and if he had made any invention, he certainly had communicated to Mr. Trewby and others months before the 27th of March, 1872. The plaintiff could not get rid of his distinct admission that what he thought were inventions had been communicated to Mr. Trewby before that date, by saying it was a slip. It might be quite true that the communication did not make much effect upon Mr. Trewby's mind; but the conversations which took place were the conversations of a public officer in the execution of his duty. Supposing they were the conversations of a man who intended to take out a patent, could he come to the defendants servant, and after saying, if you do so-and-so you will effect a great improvement, and the servant did, at great expense, alter the works, carry it out, and make the improvement, could he turn round and say he was the inventor, and claim royalties? The plaintiff might say, true it was public, but that he told the servant in confidence. He told the servant it as a fact, and the servant had used it as a fact. He submitted that the plaintiff had not employed the company's servant as his own servant to invent for him, for he could not serve two masters in that way; and the plaintiff was not entitled to say: "We put our heads together, I was the master, he the servant, and between us we made the invention." If there was anything in the invention, the plaintiff had lost all claim to it by telling the servant who put it into execution before the date of the patent. There were several other letters in the parliamentary papers to which he would now direct attention.

Mr. KAY objected to the letters being read, as they were not in evidence.

The VICE-CHANCELLOR said they must be proved in the usual way.

Mr. SOUTHGATE said he would do so at a later period. The law was perfectly well settled, that if a person united several matters in one patent, and one was bad, the patent was useless with respect to the others. In support of this point the learned counsel quoted the cases of *Hill v. Thompson*, 8 Taunton; *Brunton v. Hawkes*, 4 Barnewall and Alderson, 541; *Hay v. Marshall*, 8 Clark and Finelly, 245; *Morgan v. Seaward*, 2 Meeson and Welsby, 544; and *Simpson v. Holloday*, 1 Law Reports, House of Lords, 320. Then, what was the plaintiff's patent. First, the patent related to the purification of coal gas from sulphur in other forms than that of sulphuretted hydrogen, by means of sulphide of calcium; secondly, it related to a principle and process of working lime purifiers, whereby the carbonic acid in the gas was eliminated by the action of the first purifier or purifiers of the series, in such manner that the lime in the subsequent purifiers was converted, either wholly or to any extent that might be desired, into sulphide of calcium. Thirdly, it related to the use of washers or scrubbers containing a solution of caustic soda, or of potash, or of ammonia, by the employment of which vessels the carbonic acid was eliminated from the gas in such manner, that when the washers or scrubbers were placed before ordinary lime purifiers, the contents of those purifiers could be converted into sulphide of calcium, and thereafter maintained in that form; and when the washers or scrubbers were placed before purifying vessels containing sulphides of calcium or sulphides of sodium, the contents of those vessels could be maintained in the form of sulphides. Fourthly, it related to the purification of coal gas from sulphur existing in other forms than that of sulphuretted hydrogen, by means of washers or scrubbers containing a solution of caustic soda or of potash, through which vessels the gas was passed after it had been purified from sulphuretted hydrogen and carbonic acid. Fifthly, it related to the purification of coal gas from sulphur existing in other forms than that of sulphuretted hydrogen, by means of sulphur in a fine state of division, and in conjunction with an inert subetance, or in combination with soda or with lime, or with lime and soda together, in solution or otherwise. Then in the claim he stated that, having described and particularly ascertained the nature of the invention, and the manner in which the same was or might be used or carried into effect, he would, in conclusion, observe that what he considered to be novel and original was, firstly, the employment of sulphides of calcium in separate purifiers as a means of purifying coal gas from sulphur, existing in other forms than that of sulphuretted hydrogen. Secondly, a method or system of employing lime purifiers in the manner described, whereby the contents of all the purifiers, or of any required number of them, could be converted into sulphides of calcium, and also, if required, be maintained in that condition. Thirdly, the employment of a solution of caustic soda, or of potash, or of ammonia, used in washers or scrubbers, in the manner described, in order to eliminate carbonic acid from coal gas, and in such a manner as to convert the lime in the purifiers, or the soda solution contained in any required number of the washers or scrubbers, into sulphide of calcium and sulphides of sodium respectively, and also, if required, to maintain them in that condition. Fourthly, the employment of the soda washers or scrubbers, after the gas had been purified from carbonic acid and sulphuretted hydrogen, as a means of purifying the gas from sulphur existing in other forms than that of sulphuretted hydrogen. Fifthly, the employment of sulphur in a fine state of division, in conjunction with an inert substance suitable to form a porous material through which the gas might pass freely, or in combination with lime or with soda, or lime and soda together, in solution or otherwise, in order to effect the purification of coal gas from sulphur existing therein in other forms than that of sulphuretted hydrogen. Now, although those things were all somewhat connected, there was a specification of five different subjects of invention; and, if any one of them was not a good one, there was an end of the patent. The first claimed the use of sulphide of calcium generally, in separate purifiers; but it could only be had in separate purifiers, and it was perfectly plain that, though he called it sulphide of calcium in separate purifiers, he was speaking of the state in which the lime was when the sulphuretted hydrogen had entered into it, and before the carbonic acid had displaced any of it. According to the evidence, it was perfectly plain that that was the meaning of sulphide of calcium. Dr. Odling, in his evidence, stated that the completely decarbonated gas should be treated to remove from it its sulphur not in the form of sulphuretted hydrogen; and with this view it should be passed through a set of purifiers, charged with lime that is left unchanged for weeks, and even months, together. Whether or not there was a substance which a chemist might call pure sulphide of calcium for laboratory purposes, he did not know; but, for the purpose they had to deal with, it was lime saturated with sulphuretted hydrogen, and before the carbonic acid had displaced the sulphuretted hydrogen. The first claim was the principle of the patent the plaintiff thought he had discovered—that sulphide of calcium would purify coal gas from sulphur existing in other forms than sulphuretted hydrogen. He submitted that that was so universally known, not merely to scientific persons for laboratory purposes, but to gas managers, that it could not have been the subject of a patent.

The VICE-CHANCELLOR: Employed in "separate purifiers."

Mr. SOUTHGATE said it could not be pure sulphide of calcium, unless it were in a purifier by itself.

The VICE-CHANCELLOR said the specification stated that, if a separate purifier were filled with sulphide of calcium, that would purify the gas from sulphur in other forms than sulphuretted hydrogen.

Mr. SOUTHGATE assented. Then the plaintiff set out the mode in which he worked the new principle; and he said—as he had a perfect right to if he were correct in his facts—that he had found out a principle. As he could not have a patent for a principle alone, he would state one or two modes of working that principle, and so become entitled to the right of working the principle. Then he set out the modes, which were as follows:—A purifier, or purifiers, was used containing pure sulphide of calcium, into which the gas was passed after being purified from sulphuretted hydrogen and carbonic acid, for the purpose of absorbing the sulphocarbons. A second purifier should be used, containing fresh lime or oxide of iron, to arrest any sulphur compounds passing forward from the previous vessel, containing sulphide of calcium. When the first purifier became saturated to such an extent as to be no longer capable of efficiently absorbing the sulphur carbons, it was to be charged anew with fresh sulphide of calcium. It was not indispensable that the whole of the carbonic acid or the sulphuretted hydrogen should be eliminated from the gas before it entered the sulphide of calcium purifiers. The less carbonic acid and sulphuretted hydrogen entered the purifiers, the longer would their contents remain in an efficient condition for purifying the gas from sulphur in other forms than sulphuretted hydrogen. When the gas had previously been completely purified from carbonic acid and sulphuretted hydrogen, the contents of the sulphide of calcium purifiers would remain efficient for a long time, seeing that the only fouling element which entered was the small amount of sulphur existing in the gas in other forms than sulphuretted hydrogen. If any carbonic acid or sulphuretted hydrogen entered the purifiers, the fresh lime in the subsequent purifiers would quickly be converted into sulphide of calcium by an overthrow of sulphur compounds expelled from the anterior purifiers by the carbonic acid. That was the first claim. Then the plaintiff said, under the patent he proposed to eliminate carbonic acid from gas in such a manner that, in any required number of the purifiers, the lime should be converted into, and, as far as required, maintained in the form of sulphide of calcium, and, in so doing, turned to account the superior affinity which carbonic acid had for lime, for soda, for potash, and for ammonia, compared with sulphuretted hydrogen. One process of applying such principle was by passing the gas through the first lime purifier or purifiers of the series for such a time that the carbonic acid should have expelled sulphuretted hydrogen from the purifier or purifiers, taking its place and driving it forward into the succeeding purifiers. By this means the carbonic acid could be wholly eliminated from the gas by the first purifier or purifiers, while sulphuretted hydrogen being driven forward converted the contents of the succeeding purifier or purifiers into sulphide of calcium, which was a highly efficient material for purifying the gas from sulphur in other forms than sulphuretted hydrogen. Thereupon the latter mentioned purifiers containing sulphides of calcium might be used first in the series, and the gas passed through them into subsequent purifiers containing fresh lime, whereby the contents of the subsequent purifiers, or of any one of them, could be converted in turn into sulphide of calcium. Now it was plain that that was the identical mode which had been in use ever since 1867 at Bow, and all the witnesses were clear upon that. Then came the alternative—or the first purifier or purifiers of the series might be constantly employed chiefly for the purpose of eliminating the carbonic acid from the gas, while sulphur in all forms was eliminated from the gas in the succeeding purifiers. That was the mode which, as he understood, they were recently using at Beckton; and if he was right in his view of the law, he submitted that if a person made two claims, and one was bad, he could not sustain the patent; and if he gave to two claims an alternative, and one was bad, it was a bad patent. His proposition was, that the Bow works showed conclusively that beginning with "one process" down to the word "or," described exactly to demonstration the process carried on at Bow. He admitted the next part described that which was tried once by way of experiment by Mr. Trewby, but it had never been carried out at the works, except when they made an outdoor purifier in connexion with purifying-house No. 3, which, if the patent was good in all its parts, was an infringement of the plaintiff's patent. With regard to three, four, and five, very little had been said about them by his learned friends on the other side. The plaintiff, in the box, admitted that potash could not be used, because it was too expensive, and he also said he did not think much of No. 4, an admission which, in the mouth of the inventor, was equivalent to saying there was nothing at all in No. 4. There was very little evidence upon the point, and it would be found they were doing precisely the thing in scrubbers, which had always been dealt with in scrubbers. The plaintiff seemed to have got some notion that if he increased the power of a liquid by means of an alkali, he would increase the scrubbing power; and upon the evidence it appeared that the same sort of idea had occurred to a great many people, though it utterly and hopelessly failed years ago. It was perfectly clear the plaintiff had never tried his publication, and when he said they were new matters, they were only able to deal with them by answering as to general knowledge; and the plaintiff had not given the slightest evidence of any scientific person other than himself, that the third, fourth, or fifth head had the slightest novelty in it, and of course, if it had not, there was an end to the patent.

The VICE-CHANCELLOR said the defendants, in their answer, stated they had never tried the processes purporting to be described in the third, fourth, and fifth heads of the pretended invention, and had no intention of doing so; but they believed there was no novelty in any of them, and that such processes were of no practical value whatever for the purification of gas from sulphur, or for any other purposes.

Mr. SOUTHGATE said that was so; the defendants had not the slightest intention of trying them, but they put them in issue. Mr. Evans, in his affidavit, stated that there was not, at the date of the patent, any novelty in any of the processes described in the third, fourth, and fifth heads of the pretended invention, such processes being all well known to gas engineers, who had used

them in the purification of gas; but such processes had long since been abandoned by them. Mr. Evans also said that the action of the bisulphide of carbon on sulphur as a solvent was well known, and had been shown the plaintiff, as one of the agents for ascertaining the amount of free sulphur in the oxide of iron mixture. Theoretically, oxide of iron, which always, after being used in gas preparations, contained free sulphur, should act on the bisulphide of carbon, though the plaintiff said he had found that free sulphur reduced the amount from 12 to 12½ grains. If that was so, then the use of lime, and the plaintiff's so-called invention, would no longer be necessary, but practically it did not do so; in fact, there was little or no action, for the reason that bisulphide of carbon was extremely volatile, and was no sooner exposed to air, or to any current, than it was given off again. All the experiments said by the plaintiff to have been made with soda, &c., were old and practically useless, on account of the expense, and had been several times patented, tried, and abandoned. That statement of Mr. Evans had not been touched by the affidavits in reply. The plaintiff, in cross-examination, said he did not think much of the fourth head of his invention, because he considered the sulphide of calcium, which was the first, the better of the two. The idea was simply to put soda in to mix with the water in the scrubbers, but whether that would blow the scrubbers to pieces he did not know. As to No. 3, the plaintiff was cross-examined at some length, and said the sulphuretted hydrogen had to be eliminated in any vessel. He would put the oxide of iron anywhere, but he did not claim taking out sulphuretted hydrogen at all. The plaintiff seemed to have a notion that, if he added soda or equivalent subjects—alkalies—to water, it would have a cleansing effect. It was perfectly plain that the plaintiff had an idea that soda was an alkali, that there were other alkalies which he could use, and he had better lump them together. He evidently thought, if he could keep his grip on the first and second heads, he did not care much about the third, fourth, and fifth. In the fourth head he expressly mentioned potash. His lordship would probably recollect the story of the sawdust in the bottle, as described by the plaintiff. As to the patent of Mr. Hills, it was a process for revivifying oxide of iron, after it had become clogged with sulphuretted hydrogen, in a certain way, by exposure to the atmosphere, turning the sulphuretted hydrogen into the ordinary commercial sulphur, so that the material consisted of oxide of iron, and in the pores of that substance, sulphur. Every gas-works in the kingdom which used oxide of iron, since Hills's patent became public property, used revivified oxide of iron. Therefore, if the plaintiff's patent was a good one, every gas company in the kingdom using revivified oxide of iron—and every gas company did—was infringing the plaintiff's patent. The plaintiff admitted it was an inert substance so far as bisulphide of carbon was concerned. Bisulphide of carbon had no effect whatever upon the oxide of iron, but oxide of iron was for other purposes; for instance, for the purpose of arresting sulphuretted hydrogen, a very potent substance, and he said when he spoke of an inert substance in the fifth claim, it must be taken to mean an inert substance altogether. It was a question whether upon the fifth claim "inert substance" meant a thing inert to everything (if there was such a thing in nature), or with reference to that of which the claim was speaking. Revivified oxide of iron was that substance; the plaintiff had not pointed out that fact, and therefore the specification was bad on that ground. A curious suggestion made in the patent was very much referred to. All the witnesses were agreed, including the plaintiff, that sulphide of calcium was lime saturated with sulphuretted hydrogen. Whether the plaintiff attached any meaning to sulphide of calcium under the form he spoke of it in the provisional specification, which he described as pure sulphide of calcium, he did not know. There was always a difficulty in dealing with patents not put into operation. But that the plaintiff did not mean the ordinary commercial sulphide of calcium was pretty plain, because he said it was not indispensable that the whole of the carbonic acid, or of the sulphuretted hydrogen should be eliminated from the gas before it entered the sulphide of calcium purifiers. If any carbonic acid were admitted into the sulphide of calcium purifiers, of course there was an end to the pure sulphide of calcium, or sulphide of calcium as distinct from gas lime, or foul lime, and every one of the witnesses said that, in truth, there was no such thing as pure sulphide of calcium. Then as to novelty. With regard to the Bow works, his lordship had the evidence of Mr. Evans, Mr. Trewby, Mr. Harris, Mr. Carpenter, Dr. Letheby, Dr. Odling, and Mr. Mann. Mr. Mann gave up his patent in consequence of what they were doing at Bow. What was there on the other side? Not one of the plaintiff's witnesses-in-chief mentioned the Beckton works at all, or mentioned Mann's patent at all. It was admitted that the only gentleman who came forward as a scientific witness, Dr. Stephenson, did not know when he made his affidavit-in-chief, of the existence of Mann's patent. Surely, if the plaintiff were conducting his case in the ordinary way, and without that overweening belief in his infallibility which the plaintiff seemed to have, the least he might have done when he got the witnesses to give evidence for him, would have been to have said: "These gentlemen say they are carrying on precisely my processes at Bow, and have been doing that for some years; will you go and look at the Bow process, and see how that is?" He did not do anything of the kind. His witnesses only said that previously to that time they did not know anything about sulphide of calcium, and the evidence as to Bow was positively uncontradicted. It was conclusively proved that the first alternative of the plaintiff's patent had been in use at Bow, absolutely as it was at the present time, since April, 1867, and without imputing the grossest perjury of the grossest kind to the defendants witnesses, it would be utterly impossible for the court to come to any other decision. The matter stood thus—that anything said against Bow was said at the bar, or *arguendo*, by the plaintiff in his affidavit in reply. The plaintiff's counsel tried to make out that the first form was a limited form of claim of sulphide of calcium. So far as the plaintiff was entitled to the benefit of separate purifiers, there was nothing to be said against that, because sulphide of calcium could not be otherwise than in a separate purifier. But the plaintiff's counsel wanted to make out that the first claim was limited by the second.

Mr. KAY said he had never dreamt of such a thing.

Mr. SOUTHGATE: Very well, then, he would say no more about it than this—that in the second they got a mode or system of employing lime purifiers in the manner before described. That was the case of *Jordan v. Moore*, 1st Law Reports, C.P., p. 642. The plaintiff there claimed, as patentee, every means of combining wood and iron in the manufacture of ships, and went on to make claims involved in what he called the principle. The jury found that one of the things was a new invention, but that union of wood and iron in ships was not, and it was held that it was a bad patent, because he had claimed generally in his first claim. *Simpson v. Halladay* stood on precisely the same principle. Every one of the witnesses spoke of the want of novelty in the shifting of the purifiers. Mr. Evans and Mr. Trewby proved it was done years ago at Westminster. They afterwards gave up that plan, and took to the oxide of iron; but from 1850 to 1865, at Westminster, they were carrying on the works with the lime purifiers, and testing for carbonic acid. Of course, there could be no claim for novelty in testing for carbonic acid. Mr. Kirkham proved that the same thing went on at the Imperial works. They put Mr. Kirkham into the box, and asked him about a letter which he wrote, but they did not cross-examine him as to the main point of his affidavit; he said his mode of working was essentially the same as that described in the plaintiff's patent. As to Beckton, the court had the evidence of Dr. Letheby, Dr. Odling, Mr. Evans, and Mr. Trewby, to the effect that there was no novelty in the third, fourth, and fifth heads of the plaintiff's patent. The plaintiff was ignorant that his patent went altogether, if he put in anything which was not valid. He admitted that Trewby's letters of the 19th of February and the 29th of March, and Dr. Letheby's evidence as to what took place on the 11th of March, all described his invention. He did not pretend that anybody had seen his patent, or was working under his invention as early as the 11th of March; therefore, unless the court come to the conclusion that from something or other from which the plaintiff drew inferences, he had conclusively proved the untruth of the statement in those letters, there was an end of the case. But how or why Mr. Trewby should make an untrue statement, he did not know. What a clever man he must have been to have written a letter on the 19th of February in order to invalidate a patent which was not taken out. In any view of the case, user from February, to the 11th of March, 1873, in a public place of that kind, would be user, which would prevent the novelty. What possible doubt could there be about it? It might as well be argued that the use of an invention in a public street like Holborn was not a publication. Then as to Mann's specification. Mann was the superintendent of the defendants works at Blackfriars, and he practically was a little out of the process, because he could not use lime under the regulations of the Act of Parliament. In 1853 he took out a patent for extracting carbonic acid in the first instance by ammonia, with the water mixed with lime, which was going wonderfully near to the plaintiff's patent for extracting carbonic acid by alkalies mixed with water in the scrubbers, and the plaintiff's counsel admitted, in opening, that Mann was on the right path. It would be for him (the learned counsel) to show that he was on the same path. It was clear that from 1853 his attention had been directed to the necessity of taking carbonic acid out of the gas, because when he was dealing with sulphide of ammonium, he said the principle to be observed was, that the gas should, by exposure to lime or oxide of iron, be freed from carbonic acid and sulphuretted hydrogen previously to its being brought into contact with the sulphide of ammonium, and that care must be taken that no more gas was allowed to pass through the lime than was found in practice to convert it into sulphide of calcium. The plaintiff said the gas was to be passed through the sulphide of calcium purifiers, after being purified from sulphuretted hydrogen and carbonic acid. It was impossible to read the two provisional specifications without seeing that the two inventions were substantially the same, and the same observation applied with equal force to the complete specification. The comment upon that was that it was said that Mann did not provide for taking out the carbonic acid by lime, and no doubt that was a fair criticism upon his patent. But Mann was a gas manager. He knew the lime must take out the carbonic acid of necessity, and therefore he said, of course, "You will, first of all, take out the carbonic acid." When Mann talked of freeing the gas from carbonic acid and sulphuretted hydrogen by lime and oxide of iron, he meant lime for carbonic acid, and oxide of iron for sulphuretted hydrogen. The case of *Betts v. Menzies* had been referred to, but anything more unlike the present case could not be conceived. In that case the plaintiff had not claimed any principle. He had not said he claimed all conceivable ways of joining two metals together by pressure, but for the making of capsules. The defendants found out an old patent in 1804, in which another man had taken out a patent for combining two metals for a totally different purpose by pressure, but giving no directions as to the mode of doing it, and doing it for totally different objects. He described the method of doing it by rolling, but did not give the proportions. All it came to was that some man in 1804 had got an idea of making two metals adhere by cohesion, but gave no particulars. It was held that Betts's patent, which did not claim the principle, but a particular process, was good. The plaintiff claimed the principle of sulphide of calcium, and set out two alternative methods for carrying that into effect. Suppose 45 years ago a patent had been taken out, in which a man had claimed the principle of purifying gas by sulphide of calcium, would it be possible to maintain the plaintiff's patent for purifying gas by sulphide of calcium as a principle? This might happen—that, in the lapse of years, words had changed their meaning, and in such a case it was not a pure question of construction, and there must be evidence to go to the jury as to the meaning of the earlier patent. But the patents in the present case were dated within three months of each other, the court was judge and jury, and there was no suggestion that the meaning of the chemical words had changed in the meantime. Two men had hit upon the same idea at the same time. Mr. Mann abandoned his patent, and did what the plaintiff would have done, if he had been wise, when his attention was called to what had been done for years at Bow. The mode of taking out carbonic acid, and the fact that it was desirable to get rid of carbonic acid, were things perfectly well known to anybody who knew anything of the rudiments of gas-making. Dr. Keates gave a description of Mann's invention, showing that he was perfectly well aware, as long ago as 1859, of the matter under discussion; and he referred to some evidence he gave upon the occasion of the passing of the Act of 1860. He said that he considered that the plaintiff's specification did not differ from Mann's, and he was not cross-examined. *Hills v. Evans* was cited, to show the court could not decide upon construction, where there was a question as to the meaning of the second specification.

Mr. KAY: Certainly not.

Mr. SOUTHGATE: Perhaps his friend, Mr. Kay, was lost at the moment in admiration of the beauty of the plaintiff's invention. *Hills v. Evans* was an authority for saying that a prior publication must be that which enables a person with ordinary knowledge to apply the discovery without further experiment. But it was for the court to compare the patents, and see if they dealt with the same subject matter. That was clearly stated by the Court of Queen's Bench, in *Thomas v. Foxwell*, 5th Jurist, p. 37. In the present case there was no such difference in the expressions in the specification. The court was judge and jury, and there was plenty of evidence. *Bush v. Fox* laid down precisely the same rule, and the court, being in possession of the contents of the two patents, the evidence of the two witnesses, and the arguments at the bar, would decide the point. Then as to the testimony. First of all there was the plaintiff himself, who was perfectly clear he had found out a great secret which was excessively valuable. He said the fact that the defendants were working in a way different from what they stated, was clear beyond all question, notwithstanding their denial; and altogether he had got a perfectly plain case. He was not the first plaintiff, and would not be the last by a great many, who was of opinion that he had got a good case. One or two things he had done which were not to be commended. For instance, he introduced himself by telling the court he had written a treatise on gas purification. A man who wrote a book was considered to know something of the subject, and obviously it was desired to impress the court with the view that the plaintiff had considerable knowledge on the subject; but, upon cross-examination, the fact came out that the treatise on gas purification had been written after the suit. Then he claimed all sorts of things; but he admitted he was aware, at the time of his invention, that chemists had found, by laboratory experiments, certain things which it was now clear were well known. No wonder, therefore, that the plaintiff easily convinced himself he had made an exceedingly novel and valuable invention. Then it was a curious remark to make on the plaintiff's evidence, but it was the fact, that the witnesses he had produced who were gas engineers, and who merely gave the most general evidence, were engineers of London companies who could not use lime at all. Mr. Jones, of Stepney, Mr. Livesey, the secretary and engineer to the South Metropolitan Company, Mr. G. W. Stevenson, Mr. H. Gore, and Mr. G. Anderson, all said they believed the plaintiff's invention to be novel; but none of them appeared to have been aware of what was done at Bow, or to have troubled themselves about it. The plaintiff, in cross-examination, admitted that he had made no experiments, except in the laboratory; that all the working experiments were made by the servants of the company, and at the expense of the company. He dealt

with the letter of March as to the communications to Mr. Trewby and others, in a way he (the learned counsel) had before referred to. Being asked whether it was known that lime had a greater affinity for carbonic acid than for sulphuretted hydrogen, he said he did not know it before the patent, but he was now aware that it was known as a chemical fact. Being therefore examined upon the expression "series of purifiers," the plaintiff said he meant "series" in a succession of vessels. Then as to the attempt which had been made by the plaintiff to invalidate the testimony of the defendants witnesses. He (the learned counsel) did not see that they were shaken in the least. He thought his friends did not quite appreciate the position of the purifiers at Bow. Dr. Letheby knew the sulphur test was used at Bow, and it seemed to him (the learned counsel) that the using of the sulphur test was far more scientific and far better than the use of the carbonic acid test, for this reason—if the carbonic acid test were kept on until it showed carbonic acid, you must get some, however slight, into the next vessel, whereas the sulphur test was directed for the very products you are anxious to keep out, and when you found they were coming more freely from the first vessel than they had been, you knew that the quantity of sulphide of calcium in the first vessel was becoming decreased; and when they rose to a certain degree, you changed the first vessel before the whole contents of it were turned into carbonate of lime. Therefore you changed earlier than with the carbonic acid process. A question was put to Dr. Letheby how he managed to test for sulphur with the sulphuretted hydrogen in the gas, and he did not think the explanation was quite appreciated. It was this:—There was a small purifier filled with oxide of iron—not a working purifier at all—which took the sulphuretted hydrogen out of the gas before it went into the sulphur test. Then Mr. Evans was pressed as to the distortion. If that were not proved, he did not know what could be. As to Mr. Mann, he explained his letter of Feb. 1, 1872. He knew the fact of having tested for carbonic acid hundreds of times, and, no doubt, every gas manager had done the same. He did not think the other side would endeavour to sustain the point on the ground that there was any novelty in testing for carbonic acid between the first and second purifiers. Their merits, if merits they had, must be something quite different from that. He had already referred to Mr. Trewby's evidence as to the state of the Beckton works until the change took place. The distortion of the purifiers, the letter of the 19th of February, the fact that the statement in that letter and the subsequent letters, were true. He did not propose to say anything with regard to the details of Mr. Carpenter's evidence. He was a man without scientific education, but he had been a valuable servant, and knew a great deal about the manufacture of gas. He said Mr. Harris's statement as to the working at Bow was correct. Mr. Harris's evidence was perfectly untouched. All that could be said was that he had said he wished he had a secret for taking out bisulphide of carbon. No doubt he would be glad if he had such a secret. But he did not mean to admit that what the plaintiff had claimed was a secret, or anything he had not been practising for many years. Dr. Keates, Dr. Redwood, and Professor Wanklyn, were not cross-examined at all. If the statements of all the defendants witnesses that the process was identical was true, could the plaintiff succeed? He would not dwell long upon the differences as to the quantities of carbonic acid and sulphuretted hydrogen. The court had the evidence, and that was sufficient. The plaintiff's estimate was that the carbonic acid was three times as much as the sulphuretted hydrogen. Although that might have been true at one time of the Beckton scrubbers, when they were imperfect, it was utterly untrue as applied to the scrubbers in proper working order. He had ventured to say that a patent for a theory as applied to a known process, was not an invention within the meaning of the patent laws; and he would not say any more upon that, but he would say that it was conclusively proved that Mann in his specification, and Trewby, on the 19th of February, 1872, had stated the theory in writing, and that Harris for years before, although he had not stated it in writing, had been carrying it out at Bow. Nobody could take out a patent for a theory and seek to restrain persons who had been acting on the same practice under the same theory, or under a different theory, from going on as they had been doing hitherto. There was one point in the case which was very singular, as stated by Dr. Letheby, which was that on the plaintiff's specification this happened. You filled his first purifier with carbonic acid. His testing machines showed carbonic acid. You then took off the first purifier, and went on, *ad infinitum*, in that way, which was the second alternative. What was the effect of that? To drive forward the sulphuretted hydrogen so that the second vessel would get entirely charged with the proceeds of the sulphur, and they must ultimately be driven forward into the gas. It seemed a certainty, as stated in Dr. Letheby's affidavit, that, if you carried out the plaintiff's invention, there were no means specified for getting over that difficulty where you acted by continually charging the first purifier. The same sort of evil did not apply to the defendants as they worked at Bow, or even if they worked with the carbonate purifiers, with the sulphur test, or with subsequent purifiers, because, when they took off the first purifier, it was not quite exhausted; it was not full as it was when you used the carbonic acid purifier; it was not full of nothing but carbonic acid. They took it off while there was something in which a small portion of sulphur compounds might remain. The plaintiff left it on until the first purifier was entirely filled with carbonic acid. Then they had that which the plaintiff did not provide at all—the oxide of iron purifier after the lime. Either the plaintiff had not properly specified his invention, or it was not capable of being worked. That the patent was for a principle, it would be wrong to the plaintiff to doubt for a moment, because he used the phrase over and over again. That it was so, was proved by the fact that in his bill he did not set out that part of his patent which referred to the machinery to carry it out. He claimed the principle that sulphide of calcium was a new invention, and that he was entitled to it in any way in which it could be used.

SATURDAY, JAN. 15.

Mr. SOUTHGATE again resumed his argument, dealing with passages in the complete specification, urging that the plaintiff claimed a principle, and directing attention to the numerous instances in which the word "principle" occurred. The plaintiff did not claim any peculiarity in the mode of testing for carbonic acid. He claimed the employment of sulphides of calcium in separate purifiers; and a system of employing lime purifiers described, whereby the contents of all of them, or any required number, could be converted into sulphide of calcium, and also, if required, be maintained in that condition. The plaintiff, in evidence, stated emphatically that the uses of a double series of vessels, or something in connexion with a double series of vessels, was "essential" to his patent, but there was nothing about that in his specification. *Arnold v. Bradbury* was cited to show that the first claim was not—as the defendants said it was—general, for using sulphide of calcium in separate purifiers, but limited to using separate purifiers as described. *Arnold v. Bradbury* was very easily distinguishable. There the patentee said he had an invention for doing particular work, which had never been done before by machinery, and such and such was the machine he was going to use; and said he claimed the production by machinery of ruffles or frills. It was said that that meant by any machinery, and that, therefore, the patent was too large. But a case cited and commented upon in *Arnold v. Bradbury*—viz., *Jordan v. Moore*—was much more like the present case, but upon that he had remarked on the previous day. The plaintiff claimed the use of sulphide of calcium in separate purifiers first, and secondly, a method or system of employing lime purifiers in the manner before described; and there could be no question upon the evidence that sulphide of calcium never could be used in any other way than in a separate purifier for purifying gas from sulphur existing in other forms than sulphuretted hydrogen; that it was not new, and that, therefore, the patent was bad. The reason why the plaintiff's claim was general was perfectly clear. He had said he did not know, at the time he took out his patent, that sulphide of calcium had ever been used for the purpose of gas purification. *Beard v. Egerton* was cited to show that a specification must be read fairly. That was all he asked the court to do. *Kay v. Marshall* was cited for the purpose of showing what was the office of a claim, and he admitted it was to define that claim, which brought them back to the question, what was the construction of the patent? *Howard v. Hardcastle* had the peculiarity that there the patentee knew perfectly well that a particular part of the thing was old, and therefore it was said there was a presumption that he did not intend to claim it. But in the present case the plaintiff believed the whole thing to be new. *Hills v. The London Gas Company* was referred to for a statement of the law, which he was not disposed to question if he could. Then there were cases which decided, that if a scientific man in his closet had had an idea of an invention, or if experiments had been made with a view to making an invention, and they came to nothing, however close they might be to the actual patent, that did not invalidate it. That he did not dispute. *Bentley v. Fleming* was much relied upon. No doubt a man might employ another to assist him in making an invention, and if so, communications with that person were privileged. But that could not apply to the present case, for the referees were making experiments and suggestions time after time, not by way of experiment, but on a large working scale. It was not pretended that the plaintiff told Trewby he intended to take out a patent. Upon the evidence it was perfectly plain that Trewby did not know till months afterwards that they had done so. *Betts v. Menzies* he had already dealt with. That was a combination and not a principal patent at all. The only other case he need mention was *Betts v. Neilson*, on the same point, in which the Lord Chancellor, referring to *Hills v. Evans*, said the court was dealing with processes; and he saw no reason to alter the language he had employed in delivering judgment in that case. Both Mann and the plaintiff claimed the use of sulphide of calcium; and although there was some difference in the apparatus to be employed, there was no great dissimilarity. The plaintiff said Mann's patent was never used; neither was his, unless he succeeded in satisfying the court that the defendants had done so, and he had a perfectly valid patent. Every one of the scientific witnesses had had the plaintiff's and Mann's specifications put into their hands, and they all said Mann's was a clear and distinct anticipation. The plaintiff had brought seven or eight witnesses to prove his case, without acquainting them with Mann's patent. Therefore, the court had not to take the two documents and construe them one against the other, because a mass of skilled and practical witnesses, acquainted with terms of art and with the details of gas manufacture, had sworn positively that Mann's was an anticipation; and they were not shaken.

Mr. FRY: Do you include Dr. Odling?

Mr. SOUTHGATE: Yes, if there were taken with it the statement that what had been going on was also an anticipation of Dr. Odling's own idea. It was only the plaintiff who thought he had made a wonderful invention, because he had put a theory to facts which everybody knew, and had been acting upon for years. Mr. Fry had contended that there was an inconsistency in the defence, because he said it was alleged it was known long ago; then that it was invented by Mann; used at Bow; then by Trewby in October, 1871; and by Trewby in February, 1872. The fallacy of that was that all the other people, except the plaintiff, did not think they had invented anything. They availed themselves of progressive knowledge and improvement, but they had long employed sulphide of calcium in a separate purifier. Comment was made on Mr. Harris's report of the 20th of June, 1872, but it was said he did not mention frequency of change. He explained that the importance of the fact in no way impressed itself on his mind, and it did not occur to him to mention it specifically. But when the document was looked at, it did contain a statement which was quite sufficient, because he said he was working the same purifiers in the same manner as he had done, with experimental exceptions, ever since their erection in 1867. Then it was said, if at Bow they were in possession of a secret, why did they not communicate it to Beckton? That entirely overlooked the fact of the state of the works at Beckton from 1870 to 1872, but there were continual references to what was being done. Then the court was asked to disbelieve the witnesses on the question of distortion, but that he would leave to the court without further remark. Mr. Aston attempted to say something of the other parts; but it was not very energetic, and he would not elaborate what he had already said. His lordship would judge whether there was anything in the position of the defendants witnesses to induce the misstatements which had been imputed to them by the plaintiff's case. He left the matter with the greatest confidence in his lordship's hand, asking the court whether it was a right way of dealing with such a case, to ask the court to disbelieve such witnesses, as regarded things which were proved over and over again; because the plaintiff, by taking a line here, a piece there, and a word in another place, said he was of opinion, notwithstanding what was sworn, that the novelty of his invention was conclusively proved. He (the learned counsel) asked the court to conclude that the novelty of the plaintiff's invention was conclusively disproved, and to dismiss the bill, with costs.

Sir HENRY JAMES, on the same side, followed. He was anxious, he said, to direct attention to the fact that, whether the patent were valid or invalid in point of law, in point of fact there was no novelty in it; and as to whatever was contained within it, the proof was now conclusive that there was absolute user of that which was alleged to be the subject of it prior to the date of the provisional specification. It would be necessary to consider what constituted the principal portion of the plaintiff's claim, and see how infringement was attempted to be made out. There was nothing very material substantially relied upon; and certainly there was no allegation of infringement, except in relation to the matters which were contained in the first and second heads of claim. When examined, it would be found that these two heads formed but one, that this was substantially all that was material to be considered, and when analyzed it became a very simple matter. The first head of claim, as stated in the language of the patent, consisted of the employment of sulphides of calcium in separate purifiers, as a means of purifying coal gas from sulphur existing in other forms than sulphuretted hydrogen. Secondly, a method or system of employing lime purifiers in the manner described, whereby the contents of all the purifiers, or any required number of them, could be converted into sulphides of calcium, and also, if required, be maintained in that condition. Those two heads formed substantially but one claim, and, if analyzed it was clear that, without the second head, unless there were a meaning to be given to the word, "separate" in the first head, which should agree with all that was stated in the second, there was no suggestion of novelty. The employment of sulphides of calcium as a means of purifying coal gas from sulphur was admitted to have been a well-known process, although the plaintiff was ignorant of it up to Christmas, 1871. He had, therefore, the task of endeavouring to obtain from the plaintiff whether it was under the first head of claim that he suggested there was any novelty in the employment of sulphide of calcium, unless it was employed in separate purifiers, and the answers given over and over again showed that the plaintiff was most unwilling to state whether he was claiming the employment of sulphides of calcium as an absorbent in purifiers, as distinguished from separate purifiers, and the plaintiff in his answer persistently referred to what was "indicated." In truth, Mr. Kay admitted that the claim was not for the action of the gas upon the sulphide of calcium, otherwise, of course, the patent would have been bad. As the ordinary process was admitted to be to pass the gas through purifiers con-

taining fresh slaked lime, of course, sulphide of calcium must have been produced, and this every one admitted to have been the ordinary process, except the employment of separate purifiers for abstracting or absorbing the carbonic acid. What did the application of separate purifiers mean in relation to the absorption of the carbonic acid? It did not mean that those purifiers were separated from the others, or that there was any valve existing in the main between the two purifiers, or that there was any special application of the first purifiers to any states of carbonic acid, and that by any process or by any regulation those purifiers could not be applied to the extraction of the sulphuretted hydrogen, or sulphide of calcium, or the compounds of sulphur other than sulphuretted hydrogen. But it meant that the time during which the first purifiers should be applied should be so regulated or so shortened, that as soon as that for which the lime had the greater affinity—namely, the carbonic acid—had been converted into carbonate of lime, then those purifiers were not permitted to work any more. Thus the plaintiff's patent was reduced to this, that there being known laws of nature—a known chemical affinity—the plaintiff had suggested that certain purifiers employed for the purpose of carrying out those laws, and with the view of allowing those laws to be exercised, should be employed for a shorter time than, according to his view, had previously been done. The proposition he (the learned counsel) had to submit upon that had two aspects. He contended that the knowledge claimed by the plaintiff never was his knowledge so as to entitle him to take out a patent at all. It was the kpowledge of other people, which he had collected by virtue of an employment which gave him an absolute right under the statute to obtain that information from others. He did so obtain knowledge from practical experiments made by other persons, and thus the novelty of the plaintiff's patent did not exist, because there had been user of all those things which were stated within the claims of the patent. It was not harsh criticism to say that up to the time when the plaintiff, by virtue of his compulsory powers, obtained knowledge from men who had been spending a portion of their lives in endeavouring to arrive at the beneficial result of extracting the impurities from gas, his mind was ignorant upon all practical matters connected with such purification. It was useless to treat the plaintiff's state of knowledge jocularly; but could anything be more extraordinary? He did not know until after Christmas, 1871, that sulphide of calcium would absorb the sulphur impurities, and that it had been mentioned in many volumes; but, in a state almost of ecstasy, he made the discovery one day sitting in his arm-chair, or by means of an experiment with some sawdust in a tumbler. That knowledge was not to be compared with the knowledge of the men from whom he derived the information for which he sought to establish a patent. The source of his knowledge the plaintiff was compelled to admit on cross-examination, and he showed that he was most cordially assisted in every way. Taking the statement of the plaintiff that he knew all the experiments that had been made, and all that had taken place at Beckton and Bow, it became very material to show what it was that he had learned from the defendants officers in relation to experiments. If that which was the subject of the patent, apart from the question of prior user, had been communicated by the manager or any servant of the defendant company to the plaintiff, in the plaintiff's performance of a public duty, those experiments being made with the common object of arriving at a result for the benefit of the public, the results having been communicated to the referees, the plaintiff had no right to seize hold of the information thus communicated to him as a public servant, convert it into the subject of a patent, and say he would claim for himself the benefit of a monopoly. In the month of October, 1871, all that was contained within the patent, so far as the principle was concerned, had been carried into effect by Mr. Trewby at the works at Beckton; and the fact that such principle had been so carried into practical working was communicated to the plaintiff. Although at a later time there had been a different mode, in slight detail, of carrying that principle into effect, yet any person who had knowledge conveyed to him of what was taking place in the month of October, could not claim novelty in relation to that slight alteration in carrying out the work. Mr. Trewby in his affidavit, and on cross-examination, had clearly shown what was done at Beckton, with which the court was perfectly familiar. To say that there was a practical difference between what was done in February, 1872, and October, 1871, was correct; but the principle was entirely the same. The object of the plaintiff's patent was that the earlier purifier should have so absorbed the carbonic acid, that the later purifiers might have sulphide of calcium untroubled with carbonic acid, so as to convert the lime into carbonate of lime. Mr. Trewby proved that that was done in October, 1871, and upon examining what was done in 1872, it would be found that two sets of purifiers were applied to the same purpose. When Mr. Trewby, in his letter, said he commenced a new plan in February, 1872, it was an alteration in mere method and detail, but, as the witness said, there was no novelty in respect of the principle. He said he obtained a certain purifying power in certain purifying vessels, devoting some to carbonic acid extraction, and others to sulphide of calcium alone. He did that in October, by the mode he described, and obtained the same result, by different means, in February. In truth, it was new as to the method, but precisely the same as to the principle. This Mr. Trewby communicated to Mr. Patterson. It might be said that was not such a user of the patent that, if the case stood there alone, the defendant company would be entitled to say there was no novelty in the invention, and there had been previous practical user. He did not care to argue that matter, for, upon the principle that the greater contained the less, if the defendant's contention in relation to the user in February were right, the October temporary employment became immaterial, and he was certain the strength of the February user was such that he need not dwell upon that in October. But the October user was material as tracing up, step by step, the action on the part of the defendant company; and it also furnished the key to the supposed discovery by the plaintiff of that which he, in his ignorance, thought was a useful invention. The month of February must be approached with the knowledge that Mr. Trewby and other persons connected with the defendant company were endeavouring to comply with that which they knew would be the public demand; that the sulphur impurity in the gas should be considerably reduced. It could scarcely be supposed, from the pressure put on the company by the referees, that the persons in the employment of the company would not use their efforts, whilst at that time the impurity in the gas had not been sufficiently reduced, to meet the regulations likely to be imposed. It was reasonable to suppose, too, that that which had taken place in October, the reduction of the sulphur impurities to 20 and 18 grains, would encourage Mr. Trewby to proceed in the same direction as he had been going. So, again, it was probable, from the letter of the 15th of February, that that which Mr. Trewby had proved by practical use, the plaintiff was also resolving in his own mind, deduced from the experiments of Mr. Trewby and others. Inasmuch as in October there had been the employment of a third purifier for the purpose of holding that which was sulphide of calcium, it was important to see what Mr. Trewby did in February. The alteration of method that he made did not in any way affect the principle. Mr. Trewby, at that time, employed the first and second purifiers in the first and second sets for the purpose of extracting the carbonic acid. If it were proved that that which Mr. Trewby said he carried into effect was done, then he submitted the case must terminate by a dismissal of the plaintiff's bill. Mr. Trewby's statement was read to the plaintiff, and he admitted that if that were done, which Mr. Trewby stated was done, it was an anticipation of the patent. That was an admission of fact by the person most interested in the inquiry. There could be no such question raised as that it was mere experiment, afterwards abandoned, because it was continuing and continuous; and thus there was an end of the plaintiff's case. He did not understand when it was the plaintiff alleged that the first infringement of his patent took place. The plaintiff did not seem to endeavour to fix it by any positive proof, but by looking at the time when there was a considerable diminution in the sulphur impurities, and whenever he found the sulphur impurities decreasing to a very small amount, he said then it was that the infringement commenced. In substance, he said, he would assume and come to the conclusion that, whenever the sulphur impurity was reduced to a low average, it must have been at that time that the defendants commenced to effect a change in their mode of working. The Beckton works were large, and if there had been at any time any alteration, other than that stated on the part of the defendants, that fact could have been established by discovery from the books, or by application to those who had been in the defendants employ. But, from first to last, there was no suggestion that there was any change whatever in the system pursued, except so far as it could be gathered from the returns that were made. The plaintiff admitted that, if Mr. Trewby did what he described, it was identical with his patent. Therefore, the case was narrowed to the issue of fact—did that user, as alleged by Mr. Trewby, take place or not? Mr. Trewby spoke most specifically to that point, giving most minutely the dates. He was cross-examined, and the case had been resolved into a charge of perjury against Mr. Trewby and others. It was not a question of mistake. There must either be truth or intentional falsehood, and the court was asked to come to the conclusion that the statement made by Mr. Trewby was an intentional misstatement, and that he, upon his oath, swore to that which he knew to be untrue. What interest had Mr. Trewby to come and commit perjury, subjecting himself to all the consequences and penalties of stating what he knew to be untrue, when, if it were untrue, it must have been in the knowledge of many hundreds of workmen employed at the works? He would accept the plaintiff's view that the contents of his own letter of the 23rd of March were untrue—the result of a "slip." Therefore, it stood thus—that, at the date of the letter of the 19th of February, the plaintiff's own view was that he had made no communication of that which formed the subject of his patent to Mr. Trewby; and that Mr. Trewby, doing whatever he did, was doing it in no way as the result of information obtained from the plaintiff. Was it possible, the genuineness of the letter of the 19th of February being admitted, to conceive that Mr. Trewby had, weeks before the patent was taken out, so seen into the future as to write that letter? Was it possible to believe that, to the secretary of his own company, he would pen that deliberate falsehood—without cause, reason, or motive suggested, and, in describing what took place, create a fiction the untruth of which could be at once detected? The only other alternative suggestion was that Mr. Phillips and he were combining at that time to obtain an untrue record, which no one could conceive would ever be of the slightest use, the patent being then unborn and unconceived! What he had said had equal force in relation to Dr. Letheby. He was a gentleman employed on behalf of the defendant company, to see what improvements and alterations could be made. He had seen what was being done, and the result was stated by Dr. Letheby in his affidavit. Therefore, Mr. Trewby wrote the letter of the 23rd of March to Dr. Letheby, who had seen the works only 12 days before, and who could easily have detected any falsehood. If the letters were true, upon what basis could the plaintiff's case rest? Mr. Evans, speaking from his great practical and personal knowledge, with regard to the Beckton works, referring to what had been done in the month of October, had corroborated all that Mr. Trewby said. Further corroboration was to be found in the statements of Dr. Letheby. What motive could Dr. Letheby have for stating what was incorrect? He did not suppose the plaintiff's counsel would suggest that Dr. Letheby could be mistaken. The plaintiff admitted that he could not doubt Dr. Letheby. Therefore, it was certain that such was the state of things existing on the 11th of March, at which time plaintiff did not suggest that any one had seen his specification. Again, therefore, there was an end of the case. It had been established that prior to any knowledge of the plaintiff's patent, that which the plaintiff admitted was identical with his process, for the infringement of which alone the suit had been instituted, had been done. It might be said, on the other side, that Mr. Trewby, and those acting on the part of the gas company, were acting entirely upon the suggestions made by the plaintiff. If they did, and if the plaintiff received from them information as to their experiments—if he went to them and said they had better do this or that, and they did it before the date of the patent—that would be a perfectly good prior user. If without any reservation of any anticipated patent right he discussed with other people how to arrive at a certain result, and, using their knowledge, made certain communications to them, surely the user having been carried into effect, having become executed, and being a thing done, no good patent could be taken out. The plaintiff's view was that it had never been known to Mr. Trewby, that by the use of the first and second purifiers, or earlier purifiers, for absorbing the carbonic acid, and so creating carbonate of lime, the unfettered use of sulphide of calcium in the later purifiers could be obtained; and he was now earnest in saying that he never gave such information to Mr. Trewby, because he was anxious to establish the fact that Mr. Trewby never could have carried such a process into effect, because he never knew it. Therefore Mr. Patterson had to endeavour to establish that prior to the 9th of March, Mr. Trewby was ignorant of that chemical fact. In the referees report of the 31st of January, Mr. Patterson wrote that it appeared impracticable entirely to exclude carbonic acid from the purifiers, and that the referees were of opinion that the detrimental action of that element might be lessened by adopting a new system in working the purifiers—viz., by keeping the two first purifiers in each house in action, not merely until they became foul, but until the carbonic acid had expelled the sulphuretted hydrogen, and taken its place. They said by this mode the largest possible amount of carbonic acid would be absorbed from the gas by the first purifiers of the series, whilst the sulphuretted hydrogen was driven forward, "converting the contents of the subsequent purifiers into sulphide of calcium." That appeared as a suggestion concerning what should be done in the future. The plaintiff's view was that that had never been communicated to Mr. Trewby. That being the principal suggestion contained in the referees report of the 31st of January, written by the plaintiff, of course, it was the intention at the time to send that suggestion to the Board of Trade, and through the Board of Trade to the public. It was now attempted to be made a monopoly by the plaintiff. But whether a monopoly or not, on the 27th of March, 1872, the plaintiff wrote in relation to that very document, giving reasons why he could not retain it any longer—"all the suggestions in the report have been communicated to Mr. Trewby and others months ago." Now he had to state, on his oath, that that was untrue. He asked the court to believe that, while he had the complete and well-considered design in his mind of keeping back the suggestions which, according to his opinion, would cure the disease they had all been consulted upon—whilst he had discovered the great and effectual remedy, which it was his duty to make public, he not only concealed it from Mr. Trewby, but, having concealed it, he so far forgot the concealment which had taken place, that on the 27th of March he could write and say he had not concealed it; whereas, in truth, he had. All the knowledge the plaintiff ever possessed was equally possessed by Mr. Trewby; and thus, the statements in the letter became intelligible—that Mr. Trewby knew all about it. If the case stood upon the affirmative of the defendant, he (the learned counsel) presumed he might say it was overwhelming as to the fact of the prior user of the patent. How was it attempted to be met? Not by the assertion that the defendants witnesses were untruthful in intention or inaccurate in observation, but by the statement of the plaintiff's counsel, who pressed this theory. Take it all, and accept it without observation; it could not be true, because the results of the workings at Beckton

showed such a maintenance of the amount of impurity as to demonstrate that the plaintiff's process was not carried into effect. All the plaintiff had said was, that the results were irreconcilable; and therefore, Mr. Trewby, Mr. Evans, and Dr. Letheby had stated that which was not correct.

(*To be continued.*)

QUEEN'S BENCH DIVISION.—Tuesday, Jan. 18.

(*Sittings in Banco, before the* Lord Chief Justice, *Justice* Mellor, *and Justice* Field.)

ELLAND-CUM-GREETLAND GAS COMPANY *v.* THE ELLAND LOCAL BOARD OF HEALTH.

Mr. Whittaker and Mr. Edwards appeared for the gas company, who were the appellants; and Mr. Maule, Q.C., and Mr. Tennant for the respondent board.

This was an application for a *mandamus* to compel the Quarter Sessions for the West Riding of Yorkshire to hear an appeal against three distinct rates made by the respondents on Aug. 11, 1875, the Quarter Sessions having refused to entertain the appeal on somewhat curious grounds. It appeared that the respondents had, by the Public Health Act, 1848, powers conferred upon them of levying a general district rate upon giving a public notice of their intention; and that on Aug. 2, 1875, notice to the district was duly given that a rate would be made on the 11th of August; on that day the Public Heath Act, 1875, containing a provision repealing the Act of 1848, but re-enacting substantially the provisions for making the rates contained in that Act and a saving clause that anything duly done or suffered under any enactment hereby repealed shall not be affected by this repeal, came into operation. The question was as to whether the rate of the 11th of August was a good rate, and whether the fact of the new Act repealing the provisions of the old rendered the rate made under the old, after the new came into operation, bad. It was admitted on behalf of the respondents that the distinction of the rates under the new would be the same as under the old, but that the basis of valuation would be different.

The Court held that the notice under the old Act enured under the new, and the provisions affecting the rate under the new being substantially the same as under the old Act, and the saving clause applying, the Quarter Sessions were wrong in refusing to hear the appeal. The court therefore granted the application.

EDINBURGH COURT OF SESSION.—Thursday, Jan. 13.

(*Before Lord* Curriehill.)

JULIUS BRÖNNER *v.* DONALD M'VEAN.

The question involved in this case was of great public interest, as it arose in consequence of the respondent infringing the right of a manufacturer and patentee to protect the use of his name, after the lapse of his patent.

The complainer, Julius Brönner, of Frankfort-on-the-Maine, sought to restrain the respondent, Donald M'Vean, gas-fitter, 14, Newton Street, Glasgow, from in any way advertising, or offering for sale, or selling, or from in any way causing to be advertised, or offered for sale, or sold, as Brönner's burners, any gas-burners not manufactured by the complainer, and from in any way inducing the public to believe that the respondent keeps for sale gas-burners manufactured by the complainer, while such was not the case. Mr. Brönner has, for some time past, carried on business at Frankfort-on-the-Maine as a manufacturer and exporter of gas-burners and other gas fittings, Messrs. Henry Greene and Son, of Cannon Street, London, being his sole consignees for the United Kingdom and Colonies; and they have appointed Mr. Horton sole agent for Scotland for the sale of these articles. It appeared that Mr. Brönner, early in 1868, invented various improvements in the construction of gas-burners, and took out patents in various foreign countries, and in Great Britain in March, 1868; and it was stated that the gas-burners manufactured by the plaintiff acquired, and still enjoy, great public reputation throughout the kingdom, on account of their accuracy of construction, and their economy in consumption of gas, and were well known in the trade as Brönner's burners. The letters patent lapsed some time ago, but the complainer has continued, and still continues, to manufacture gas-burners, and to stamp them with the trade mark "Brönner's Patent;" and he had recently discovered that the defendant, without his knowledge or consent, had sold a large quantity of gas-burners, which he represented to be Brönner's burners.

The *defendant*, in reply, averred that the complainer was continuing to stamp his burners with the words "Brönner's Patent" with fraudulent intent, and that the term "Brönner's burners" had been for several years of public right.

After a trial extending over three days, and a lengthened argument on both sides, in the course of which many analogous cases were referred to,

Lord Curriehill, in delivering judgment, said: The opinion he had formed upon this question came to be a very short one. The burners which were manufactured by Brönner himself bore the mark of "Brönner's Patent;" they bore that mark from the date of the patent, and they did so still; and the question was whether the defendant was entitled to offer for sale as Brönner's burners, burners which were not manufactured by the complainer. The plea that the term had become of public right could not, on the evidence, be sustained. The fact that the plaintiff had no patent would have been a good plea, if supported by evidence that no patent had ever existed; but that it had existed was true in strictest point of fact. His lordship held that there was nothing false or fraudulent in Mr. Brönner stamping on the burners he now made the words "Brönner's Patent," although his patent had lapsed, because his burner had, during the existence of the patent, become known by that name. His lordship quoted Lord Kingdown's observation, which he considered was perfectly sound—viz., The fundamental rule is, that no one man has a right to put off his goods for sale as goods of a rival trader; and that was what the defendant had been doing, and had thus violated the good common-law right of every manufacturer of goods, which was to have any other person prevented from selling as his, that which had not been manufactured by him; and he, therefore, granted the interdict (injunction) asked for, with expenses.

HUNTINGDON COUNTY COURT.—Wednesday, Jan. 12.

(*Before Mr.* E. Beales.)

DISPUTED GAS ACCOUNT.

HUNTINGDON AND GODMANCHESTER GAS COMPANY *v.* VEASEY.

This was a claim by the gas company for £34 10s. 10d. for gas consumed by the defendant.

Mr. Horace Browne, who appeared for the plaintiffs, said the defendant was the owner of large oil-cake mills, and for some years past had purchased his gas of the Huntingdon and Godmanchester Gas Company. The main item disputed by defendant was £19 16s. 3d., charged for gas consumed from December, 1874, to March, 1875. The other amounts were for consumption during the remaining quarters of the year. But the charge for the particular quarter was less than the charge for the corresponding quarter in 1874, so he could not see the ground of defendant's complaint. On the other hand, he considered it a fair and reasonable bill, when the past dealings with the company were considered. An Act was passed in 1859 for regulating measures used in sales of gas, and under that Act a meter inspector could be appointed, but no such inspector had been appointed in connexion with these towns and the company's works. But when the collector called on the defendant, and he refused to pay the bill, alleging that the charge was unjust, he was told that the meter should be sent up to London and be tested by the proper officials, but he refused to have it touched.

William Allen, gas-fitter and acting inspector to the company, said he took the index of Mr. Veasey's meter on the 10th of March, 1875, and entered the quantity consumed in the book. The amount consumed came to £19 16s. 3d. No complaint was made to him at the time. He inspected the meter for the quarter ending March, 1874, and the charge was £14 15s. 9d. The consumption for the whole year was £23 14s. 4d.

Thomas Lane, who was acting manager at the gas-works during 1874 and some part of 1875, stated that in consequence of a complaint that was made he took the index of some meters on the 8th of March, 1875. He found Mr. Veasey's meter the same as taken a few days back, allowing for the consumption in the interim.

Geo. Lane, manager of the gas-works, had complaints made to him by Mr. Veasey about his consumption of gas, and told him he would send his meter away to be tested if he thought proper, but Mr. Veasey declined, and told him that he must have sent something else through the mains besides gas.

The *defendant*, who conducted his own case, submitted that the consumption in preceding quarters had nothing to do with the matter; it depended upon the time the mill was running, and the quantity of cake manufactured. He did not do much business during that particular quarter, as his books would show. The gas was turned off, the mill locked up, and no one could get to the meter. He quoted numerous figures to show an excess in the charge made on him for gas for three quarters of 1875 of 43,100 feet, against the corresponding quarters of the previous year. In the year 1874 he made no complaint of the gas, for he had plenty of light, and the men could get on comfortably with their work; but in 1875, the year he was charged with this excess, the light was so bad that frequent complaints were made to the gas company. He did not complain of a want of pressure, but a want of light. The pressure was put on, and a quantity of foul air and impurity rushed through the meter. He could prove that by the quantity of dirt round the burners.

His Honour: Have you any witnesses as to complaints.

The *defendant:* The bad quality of the gas is patent to all, and your honour has shown your usual judgment in selecting a day for holding your court when there is a full moon in the evening. Otherwise your honour might have had some difficulty in finding your way out of this ill-lighted town.

Mr. *Robert Hardwick*, watchmaker, said he considered there was a general complaint in the town that the gas was impure.

Mr. H. Browne objected to this evidence, which he considered irregular.

His Honour: If this is a public scandal, I wonder the town does not use means to get it rectified. I am afraid, under the circumstances, that I cannot help you, Mr. Veasey. If there is a complaint, as I have just stated, I wonder the town does not use means to get it remedied. Evidence has been given that an offer was made to you to have the meter inspected according to the usual course of the Government inspection, and you declined the offer. The company could not do more. Judgment must be given for the full amount.

GLASGOW SHERIFF SMALL DEBT COURT.—Thursday, Jan. 13.

(*Before Sheriff* Galbraith.)

DISPUTED GAS ACCOUNT.

The Glasgow Corporation Gas Committee sued *William Hannah*, 54, Clyde Place, to recover the sum of £4 11s., alleged to be due for 16,800 cubic feet of gas consumed by the defender in his house between the 1st of July and the 18th of September, 1875.

The defence was that the defendant, who had only just entered the house at the time stated in the summons, had not burned any gas, or even touched the meter, and that the gas must have escaped, owing either to defective fittings, or the condition in which the meter was left by the previous tenant.

The Sheriff found the defender liable for the amount sued for in the first instance, although he might ultimately have a good claim against the landlord, especially if the piping was found to be defective. A tenant was liable for all the gas passing through the meter.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

Metropolitan Board of Works.—At the Meeting on Friday last, a letter was read from the Kent Water-Works Company with regard to affixing hydrants upon certain mains in the Plumstead district, stating that they cannot concur in the suggestion made by the Board of postponing the matter, and that they intend to exercise the powers conferred upon them, and will provide such plugs or hydrants in the district as shall seem necessary, and will require the Board to pay the expenses thereof, transmitting a plan showing the places where it is proposed to fix the hydrants, and intimating that due consideration will be given to any suggestion the Board may wish to make in relation thereto. Mr. E. D. Rogers proposed that the matter should be referred to the Works Committee, and that the solicitor should report as to the powers of the water company. Mr. Runtz, in seconding the motion, said it appeared a somewhat extraordinary proceeding on the part of the Kent Water-Works Company, seeing that the whole question would have to be considered by Parliament in the ensuing session. A great deal of nonsense was being talked abroad on the subject of hydrants, and he thought the Board would do well to inform the consumers as to the effect of the system as far as their pockets were considered. Mr. Leslie said that in Liverpool and Manchester, where the hydrant system was in great force, large fires were more numerous, and caused greater damage than in almost any other place. He thought hydrants little better than "squirts," and of very little use. Mr. Newton said he thought it desirable that the committee should be prepared to show where there were hydrants already, and were there were street-plugs, as that would assist them to arrive at a conclusion. The water company were not taking this action to benefit the public, but they had kept some districts under high pressure, and now found the plugs were not strong enough to resist it. They consequently now wished to put up hydrants at the ratepayers expense. The question was then referred to the Works Committee for report.

Dr. Frankland, F.R.S., reports as the result of his analysis of the waters supplied to the Metropolis during December, that, taking unity to represent the amount of organic impurity in a given volume of the Kent Company's water, the proportional amount found in an equal volume of the water supplied by each of the other metropolitan companies was—Grand Junction 2·3, Chelsea 2·4, West Middlesex 2·6, New River 2·7, Southwark 2·8, Lambeth 3·3, and East London 3·6. In consequence of the subsidence of the floods, the quality of the Thames water showed a marked improvement. The Grand Junction Company, on the 7th of December, delivered water which was slightly turbid and contained moving organisms, whereas that supplied by each of the other river companies was efficiently filtered. The temperature of the river water delivered in London, on the 7th of December, averaged rather less than 35° Fahr., only 3° above freezing point, whereas the temperature of the water supplied by the Kent Company from deep wells in the chalk was 50·9°, and nearly 16° higher than that of the river water. In order to show the advantage resulting from domestic filtration of the water supplied to London, Dr. Frankland draws attention to the effect of filtering a sample of the Grand Junction Company's water, as delivered last month, through spongy iron and animal charcoal; after filtration, all turbidity had disappeared, the proportion of solid impurity was reduced from 32 to 20, of hardness from 23 to 16, and the organic matter by more than three-fourths. By this method of filtration a considerable proportion of the organic matter is converted into ammonia, which in itself is harmless.

Major Bolton reports that during the month of December the state of the water in the river Thames at Hampton, Molesey, and Sunbury, where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, and East London Companies are situated, was good. The highest flood state of the river at Hampton during the month was 1 foot 4 inches above the (6 feet) summer level, and the lowest was 5 inches above summer level. At Seething Wells, Kingston, where the intake of the Chelsea Company is situate, the state of the water in the river was good during the earlier part of the month, and bad during the latter half. The highest state of the flood water at this place was 2 feet 1 inch above, and the lowest was 8 inches above summer level. The highest temperature of the water during the month was 46°, and the lowest 33°, while the highest temperature of the air at the same place was 51°, and the lowest 26°. These observations were made daily at 9 a.m. The rainfall during the month was 1·55 inches.

BIRMINGHAM AND STAFFORDSHIRE GAS COMPANY.

A Special General Meeting of this Company was held on Tuesday, the 18th inst.—Mr. W. SHARP in the chair—for the purpose of passing resolutions to effect the winding-up of the concern on the transfer of the business to the corporation.

After the usual formalities, the following report was presented:—

The directors have to report that the sale of the company's undertaking to the corporation was completed on the 1st day of January inst.

In conformity with the arrangement embodied in the agreement of Dec. 29, 1875, entered into pursuant to the resolution of the special general meeting, held on the 28th day of that month, the corporation paid to the company the sum of £29,145, to admit of the payment of the maximum dividend for the half year ending Dec. 31, 1875, and which dividend the directors now recommend the shareholders to declare.

In pursuance of the same arrangement the corporation also paid the sums following, namely:—Moneys capitalized by the Act 27 and 28 Victoria, cap. 239, not bearing dividend, £10,906; reserve-fund, £39,609 11s. 8d.; undivided profits to June 30, 1875, £9185 4s. 6d.; surplus profits, for half year ending Dec. 31, 1875, £15,000—£74,700 16s. 2d.

In addition the corporation have since paid, in repayment of costs paid by the company, £422 7s. 1d.; making the total sum at the disposal of the company, after payment of the proposed dividend, £75,143 3s. 3d.

By section 6 of the Birmingham (Corporation) Gas Act, 1875 (the Act authorizing the transfer), it is provided that all moneys belonging to the company are to be held in trust after payment thereout of the costs and expenses not paid by the corporation, "to pay any sums the company may in general meeting order to be paid to officers, servants, agents, and others connected with the company, and to distribute the residue among the shareholders of the company, their executors, administrators, or assigns, according to the resolution of the company in general meeting."

It is intended to exercise these powers at this meeting, and your directors propose to ask for votes for—1. A sum of £1087 3s. 3d. to cover the estimated costs incidental to winding-up the company and distributing its assets, including the salaries of the secretary and cashier up to the 31st of March next; 2. A sum to be divided among certain of the officers and others; and 3. The distribution of the balance.

The proposed vote of £1087 3s. 3d., under head No. 1, will leave a sum of £74,056, which will suffice to pay the shareholders a bonus of £67,040, equal to 10 per cent. on their paid-up capital, and will leave a balance of £7016 available at the discretion of the meeting for division among "the officers, servants, agents, and others connected with the company."

The directors cannot conclude their report without referring, as they do with regret, to the recent death of their late colleague, Mr. Blakeway, whose long connexion with the company, and whose valuable services on its behalf, are well known to the shareholders.

The CHAIRMAN moved the adoption of the report, which was seconded by Mr. HEATON and carried unanimously. The chairman then moved—"That a dividend out of the sum paid by the corporation in substitution for the profits of the half year ended on the 31st day of December last be, and is hereby declared and made, at the rate of 10 per centum per annum upon the capital of £320,400 existing under the Act of 8th and 9th Vict., cap. 66, and at the rate of £7 10s. per centum per annum upon the capital of £350,000 raised under 'The Birmingham and Staffordshire Gas (New Capital) Act, 1858,' and that such dividend be payable upon and after the 19th day of January inst." In proposing the resolution, he remarked that the present meeting might be said to be of a funereal character. They had met that day to bury or to dispose of their old friend, their valuable friend, yea, he might say their lamented friend, the Birmingham and Staffordshire Gaslight Company. It had existed for many years, he might say for fifty years; but its remains had now been formally deposited in the custody of the Corporation of Birmingham, and that was so done on the 1st of this month. But, mournful as that event might appear in words, yet it was a comfort to know that their friend still lived, or that under another name he would continue to dispense the same favours in the future that he had done in the past. Moreover, he had secured to them the guarantee not only of their principal, but of their interest, in the form of annuities; and moreover, he had left behind him a very large sum of money, which would enable the trustees—the shareholders and directors—to partake of, share and share alike, in a legacy—and a very handsome one.

Mr. HEATON seconded the motion, and it was at once adopted.

The CHAIRMAN next moved—"That out of the cash balance of £75,143 3s. 3d., which will remain to the credit of the company after providing for the dividend so declared, and which balance will, after such deduction, constitute all the money then belonging to the company, the following payments shall, pursuant to the provisions and powers of 'The Birmingham (Corporation) Gas Act, 1875,' be made, namely:—To the directors of the company the sum of £1087 3s. 3d., to be by them applied in payment or satisfaction of the unpaid costs, charges, and expenses of the company not paid or payable by the corporation, and the estimated costs, charges, and expenses which will be incurred by the directors in distributing the assets and winding-up the affairs of the company pursuant to the 10th section of the last-mentioned Act."

Mr. HEATON, in seconding the motion, said the estimate of winding-up and other objects included in the resolution had been made moderately, but the sum reserved was thought necessary to meet all expenses; it was a matter they must ask to be left to the discretion of the directors.

The motion was put and carried.

Mr. HEATON moved that the sum of £500 be voted to the directors, to be by them expended in acknowledging in a suitable manner the zealous and able services rendered to the company by their solicitor, Mr. W. Evans, and especially for his able conduct of the parlimentary and other proceedings in connexion with the transfer of the company's undertaking to the corporation.

The motion was seconded and carried with applause, and Mr. Evans acknowleged the same.

Mr. JAFFRAY, after speaking in highly laudatory terms of the services rendered to the company by the directors, proposed—"That the sum of £1000 be voted to the directors for the following purposes—namely, £200 to be placed at the disposal of the chairman, and a like sum at the disposal of the vice-chairman, for the purchase of a piece of plate, in special recognition of their services to the company; and that the balance of such sum of £1000 be divided rateably among the whole of the directors."

The motion was seconded by Mr. Chesshire, and carried unanimously.

The CHAIRMAN, in acknowledging the compliment, thanked the shareholders sincerely for their commendation at the last meeting. Their approval would have been quite sufficient to meet his expectations; but being coupled as this was with words of praise and a gift so palatable, they could not but appreciate it as a record of the feelings of the shareholders in their favour. And while he, in taking his farewell of them, thanked them for what they had done on his and his friends behalf, he could assure them that their gift would not only be long remembered, but their kind words also.

A resolution was then passed placing the sum of £5516 at the disposal of the directors, to be distributed by them among such of the other officers, servants, and agents connected with the company as they might select, and in such proportions and manner as they might prescribe.

The next resolution related to was the allocation of the 10 per cent. to the shareholders, and was as follows:—"That the residue of the said cash balance of £75,143 3s. 3d., being the sum of £67,040, shall be by the directors distributed amongst the shareholders of the company, and their respective executors, administrators, or assigns, in the respective proportions following—namely, For each share of £50, the sum of £5; for each share of £25, the sum of £2 10s.; for each share of £20, the sum of £2; and for each share of £28, the sum of £2 16s. All which sums shall be considered and applied as capital in right of the respective shares in the capital of the company, with reference to which the same sums shall be paid."

Formal resolutions were subsequently adopted for ratifying the acts and proceedings of the present and former directors, and for winding-up the affairs of the company with all practicable speed.

The proceedings closed, with votes of thanks to the Mayor and Gas Committee of the Corporation for the use of the room for the meeting, and to the chairman for presiding on the occasion.

EUROPEAN GAS COMPANY, LIMITED.

The Half-Yearly General Meeting of the Shareholders of this Company was held at the Offices, Austinfriars, London, on Wednesday, the 19th inst.—W. WHITE, Esq., in the chair.

Mr. H. M'L. BACKLER, the general manager of the company, read the notice convening the meeting, and the following report of the directors:—

Gentlemen,—Your directors have the pleasure to report that the returns for the past half year, received from the six stations, have, in the aggregate, justified their expectations regarding the development of the company's business. The only exceptions occur at Amiens and Boulogne, where no great improvement has yet taken place, owing, in the first case, to the closing of several factories, and the transfer to other districts of manufactures previously carried on there.

As regards Boulogne, the wet summer and autumn had an unfavourable influence, by preventing the customary great influx of visitors during the bathing season. The wreck of the *Charles Dickens*, which closed all access of shipping to the port for several weeks, had a damaging effect on the trade of the town, which does not appear to have yet quite recovered from the blow it then received.

At Caen, Hâvre, Nantes, and Rouen, the progress made has been completely satisfactory. This continuous increase in the consumption of gas will render some extensions necessary, in addition to those mentioned at the annual meeting.

At both Nantes and Rouen, the purifying apparatus must be enlarged. A new station-meter should also be provided at the latter establishment.

Further improvements may be required in the course of the year, but the outlay involved in such extra works will not be very considerable.

Your directors have not had occasion since the last annual meeting to enter into any new contracts for coals. They believe the tendency at this moment to be towards lower rates, and will endeavour to avail themselves of the most favourable opportunities to secure the current year's supply.

The average price realized for coke is lower than that of last year, and the mildness of part of the winter having, so far, tended to limit sales, stocks have been accumulated at two of the stations. The managers are, however, being urged to do all in their power to dispose of the same before the close of the present season.

Debentures to the amount of £9400, bearing 5½ and 5 per cent. interest, became due recently. Of this sum, £7600 was at once renewed at 4½ per cent., and the balance paid off out of the general resources of the company.

Your directors do not doubt that this will be as gratifying to you as it is to them, affording additional proof of the high and growing esteem in which the securities of this company are held, and which they believe to be fully warranted by its substantial position, as well as by its continually brightening prospects.

The usual interim dividend for the half year, at the rate of 8 per cent. per annum, will be paid on the 1st of February, by warrants to be forwarded to the shareholders on the previous day.

The CHAIRMAN: Ladies and gentlemen, allow me to remind you that, at this time of the year, we lay no accounts or statement of our balance before the proprietors. This is a meeting at which we only lay before you a somewhat general sketch, as the report just read has done, of the progress we have made during the previous six months. And, in reference to that period, I may say that it has been a most uneventful one; and it is a great relief, not only to the directors, but to every one else connected with the company, that our proceedings have been of a very routine character. In fact, we have found some little difficulty in making up a report at all as to the state of our affairs, as we are bound to, according to our arrangement with the shareholders. The natural growth of our business has been such that it is quite sufficient for me to assure you that the company are, upon the whole, in a highly prosperous condition, and that the nature of this prosperity is such that we have good reason to believe it will be maintained. Of course we have had, as usual, some drawbacks. This is always the case, more or less, with a manufacturing company; but I venture to hope that those drawbacks, which have arisen principally at Amiens and Boulogne, as mentioned in the report, will soon be remedied, and that we shall have cause to say, when we meet you again this time six months hence, that in this respect also things are in a satisfactory condition. We are not, as we have informed you, able to get the same price for our coke as we had been getting for some little time, and, at the two stations just mentioned, the stock has been accumulating. However, we hope that a change in the weather may cause those stocks to run off more rapidly than has been the case recently. Possibly we shall not be able to maintain the former price, but we trust that we shall be able to recoup ourselves for this reduction, in some measure, by being in a position to get coals at a lower price; and I have little doubt that we shall obtain lower rates for freight. With regard to the outlay mentioned in the report, I may say that we shall use our best efforts to diminish it as much as possible; but those present who know anything of gas manufacture must be aware that the continual outlay of money upon the works is a symptom rather to congratulate ourselves upon, as it indicates that we are doing an increased business. And, in truth, we are extending our business at such a rate that the proposed outlay, although at first sight it may seem large, is an amount which it is absolutely necessary to expend, so as to keep up our establishments to that pitch of efficiency that will render them fully adequate to the demands made upon us. We are bound to supply gas to every person who requires it, and therefore it is quite necessary, as I said before, that all our plant and machinery should be equal to the constantly growing demands of the public. Our previous report informed you that it had become necessary to erect a new gasholder at Havre, and that at Nantes it would be necessary almost immediately to telescope the single holder we have there. These works have not been contracted for yet, but we have had one of the contracts before us to-day, and the matter is now under our consideration, as well as that of other works at Havre, Nantes, and Rouen. I need hardly say that the actual carrying out of these extensions will only take place as they become absolutely indispensable, so that when they do occur you will have an additional proof of the progressively satisfactory condition of our undertaking. Another matter mentioned in the report is that the credit of the company stands so high, that we have been able, as our debentures came due, to replace them, within about £1500—which we did not care to reissue—at 4½ per cent. I think there are not many gas companies that can place their debentures more favourably than we have done, and I am sure you will agree with me that we have every reason to congratulate ourselves that, under all the circumstances, we, as a company, are in a very prosperous condition. Having already referred to the trouble the directors had in making up a report, there being so little to tell you of the events of the last six months, it would be somewhat difficult for me to find more to say than I have said, and therefore I shall now conclude by moving—"That the report of the directors now read be received and adopted."

Mr. FAWCETT seconded the motion.

A PROPRIETOR: What is the cost of constructing a gasholder?

The CHAIRMAN: The last one erected cost us £10,000. We propose to erect one new one, and to telescope an existing one.

A PROPRIETOR: At what rate of interest were the debentures standing before?

Mr. BACKLER: 5½ and 5 per cent.—originally 6 per cent.

Mr. STOKES congratulated the directors on the state of prosperity they were able to report, and referring to the proposed erection of a gasholder, he remarked that the present seemed a very favourable time for undertaking it, on account of the low price of iron. He hoped at the next half-yearly meeting the chairman would have the pleasure of announcing an increase of at least 1 per cent. in the rate of dividend.

Mr. CHALONER SMITH: An observation fell from the last shareholder as to the construction of the new gasholder. Now, I can speak with some authority upon this subject, as I am the chairman of one of the largest iron companies in this country. And I say that I think we should be excessively foolish to delay getting out contracts for the proposed holder. My own impression is that it is very improbable we shall ever be able to obtain better terms than we can do at the present time.

The motion was then put, and carried unanimously.

A vote of thanks to the chairman and directors having been adopted,

The CHAIRMAN said, as the organ of the board, he had much pleasure in acknowledging the compliment just paid to the directors. He could only repeat what he had said for many years, that the directors, as a body, did all in their power to advance the prosperity of the company, and it was extremely gratifying to them to find that their labours had been crowned with success.

Mr. G. LIVESEY proposed a vote of thanks to the general manager, a gentleman who he believed had done more than any other individual that he knew of to promote the interests of the company. And, in moving this resolution, he could not help expressing a hope that the directors and shareholders would take such steps as would ensure that Mr. Backler's position in connexion with the company would be one of authority in the future, as it had been in the past. He was led to make these remarks in consequence of what happened at the recent extraordinary meeting for the election of a director. He did not wish to make personal remarks, but he was bound to express his opinion that on a small board, like that which managed the European Gas Company, there should not be two directors, members of one family. Mr. White, having obtained for his son a seat at the board, might hereafter secure the election of a brother or nephew, so that a preponderating influence in the councils of the company would rest with them. It was not a wise policy to sanction, and, therefore, he thought the shareholders were bound to see that Mr. Backler, upon whom so much really depended, was enabled to maintain his position in the concern.

Mr. BADDELEY seconded the motion, and said he was himself a candidate for the seat now occupied by Mr. White, jun.; but he found at the meeting that the result of the election was a foregone conclusion. The number of proxies obtained beforehand by Mr. White prevented any other shareholder from standing a chance.

A PROPRIETOR said he presumed that every shareholder had a form of proxy sent to him, and voted as he thought right. He could only remark that no pressure was put upon him to vote in any way.

The CHAIRMAN said he thought it was a great pity that such remarks had been made by the mover and seconder of the vote of thanks to the general manager. They were only calculated to promote discord between the directors and Mr. Backler, which was most undesirable. He did not intend to notice the matter further than to say that the observations made went too far, and that, as far as he (the chairman) was personally concerned, having been connected with the board for nearly 28 years, they were quite uncalled for.

Mr. STOKES wished to include in the motion a vote of thanks to the staff of the company generally, to which the mover and seconder agreed.

A PROPRIETOR regretted very much the observations made by the mover of the resolution, as they placed Mr. Backler, apparently, in conflict with the directors. He fully acknowledged the services rendered by the general manager to the company, but he could not forget that, although Mr. Backler held a very high and responsible position, the supreme control of their affairs was in the hands of the directors.

The CHAIRMAN remarked that if the shareholders were not satisfied with the conduct of the directors, they had the remedy in their own hands. They had only to intimate their wish in the matter.

A PROPRIETOR said he had great pleasure, at the extraordinary meeting, in proposing Mr. White, jun., as a director, and if the circumstances should again occur, he should take a similar course.

Another PROPRIETOR said he voted against the election of Mr. White, jun. Certainly no pressure was put upon him to vote in any other way. The sense of that meeting was clearly in favour of the appointment. It was now an accomplished fact, and it was to be regretted that any reference should be made to it.

The vote of thanks was put to the meeting and carried unanimously.

Mr. BACKLER, while thanking the mover and seconder for the kind feelings they had expressed towards him, said their subsequent remarks had been the most painful to which he had listened since his connexion with the company. Indeed, if he thought it likely such observations would be repeated, he would tender his resignation to the board. He had recently completed a period of a quarter of a century in the service of the company, and it would, perhaps, be well if he took the opportunity to refer to what had been done during that time, not at all desiring to attribute all the merit thereof to himself. When he was first appointed, the affairs of the company were in a very different state to that in which they now were. There were directors on the board who had not the least notion of the prosperity growing up under their feet. The very first transfer of shares that came before him was a transfer of £10 shares at £4 each; those shares now being worth £17. There was one director so convinced that the affairs of the company were going to ruin, that he talked of selling out; others of the directors, however, thought differently—the present chairman being the principal. Mr. White had been brought upon the board by a number of shareholders to effect an alteration in the state of affairs, and he (Mr. Backler) was then appointed secretary of the company. From that time to the present they had acted together harmoniously for the good of the concern, and he did not know how they could have done anything better than they had done. Many of those who were connected with the company then had passed away, and looking round upon the shareholders he could not see many whom he knew then as proprietors. The number at that time was 100, now it was 750; very few of the first named still remaining. The chairman was the only director left. Two other gentlemen were also elected for the same reason—Mr. Joseph Brown and Mr. Wm. Dew. These were the pioneers in the reforms which took place. He had good reason to recollect them, for though he had never seen them until they met in the board room, each left him executor of his will; the greatest trust they could repose in him. Referring again to the affairs of the company at that time, he could not help contrasting it with the present. Then the company had no legal status as a company in France; they had not even the legal right to recover the debts due to them. They had very short contracts at four of their stations, and at the other two they were exposed to competition of the sharpest kind. And what was the position of things now—a position brought about by the gentlemen who were the reforming directors at that time, at the head of whom was the present chairman, and with whom he (Mr. Backler) had acted during the whole intervening period. Not only was this company now recognized in France, but they had obtained from the French Government a recognition in that country of all British companies duly formed in England. This company had now concessions for long terms of years; they had got rid of all competition, and could defy the ill will of those who were antagonistic to them in any way. They had been able to remodel their works, to reorganize the accounts, and to put their affairs generally on a footing which, he might say, was not only the cause of the improvements, respecting which they congratulated themselves that day, but also of establishing the company on a basis likely to endure. In saying these things, he did not arrogate to himself credit for the whole, but on the present occasion he might perhaps depart from his usual reticence, and state something of what he had done individually for the progress of the company—always, be it remembered, under the direction of the board. Whenever any diplomatic action of the British Government required to be set on foot, it was done here at one time by the late chairman, Mr. Sheffield Neave, and afterwards by Mr. James White, late M.P. for Brighton, and brother of the present chairman. But all the onus of whatever was done abroad fell on his (Mr. Backler's) shoulders, and when he stated the fact that he had had to discuss important matters with such able, clever men as M. Rouher, the late Vice-Emperor, and M. Gambetta, for some time Dictator of France, and in their own language, it would be seen at once that he had had no easy task. It was gratifying to know he had invariably succeeded in obtaining everything he desired for the company. With regard to M. Rouher, he might mention that he was consulted by that statesman on the subject of the probable operation of the English Limited Liability Law in France, and assisted him in drawing the basis of the measure which had now entered into the commercial law of that country. On this a compliment had been paid him by the chairman, who said that law ought to be called "Backler's Act." That was, however, all the good he got out of it. As most present were shareholders in the company at the time, he need not remind them of what took place during the terrible Franco-German war. He would only say that he went from place to place at the risk of his life to protect the property of the company, and to collect the funds from the different stations where they were liable to be seized by requisitions. He did it willingly, and would do it again if necessary, for he always acted on the principle that a man must do his duty, whatever the consequences it involved. With regard to the coal famine, that was another matter to which he might allude. At the first appearance of the coal famine he was travelling in the West of France, on the business of the company. He saw the approaching difficulty, and started at once for Newcastle, where he arrived in time to make arrangements for contracts which enabled the company to pass through the crisis without such a serious diminution of dividend as some other companies had to suffer. With the natural growth of the company, the business requiring attention had become quadrupled; but this had been carried on without much addition to the general expenses, owing to the different offices entrusted to him from time to time for the sake of concentrated management. He apologized for having detained the proprietors so long, but remarked that the occasion was special; for it was not every one who was permitted to complete a quarter of a century with the same company.

The proceedings then terminated.

AMERICAN GASLIGHT ASSOCIATION.

[Condensed from the Report in the *American Gaslight Journal*.]

(*Continued from page* 58.)

WEDNESDAY, OCT. 20, 1875.

Dr. CHANDLER continued his address as follows:—

Products of the Distillation of Coal.

As in all cases of destructive distillation, we have four classes of products:—

1. The gases and vapours.
2. The water.
3. The tar.
4. The coke.

These products are very complex in composition, more than a hundred chemical compounds occur in them. (The diagrams exhibited the names and chemical formulæ of the most important of them.)

The Yield of Gas Coals.

The quantities of gas, ammonia water, tar, and coke obtained from coal vary according to the quality of the coal and the character of the heats. Professor J. Lawrence Smith, in his able report on the Paris Exposition, gives the following figures from the imperial gas-works in Paris, for the year 1866:—

Coal carbonized	421,000 tons.
Gas obtained	4,320,491,244 cubic feet.
Feet of gas per ton	10,262·5
Tar	21,540 tons.
Tar per cent.	5·356
Tar per ton of coal	119·97 lbs.
Tar	12·6 U.S. gals.
Ammonia products	3000 tons.

Purification.

The next thing in the operation of gas-making is purification. The impurities which are not separated from the crude gas, either in the condenser, washer, or scrubber, are all more or less objectionable. All the sulphur compounds produce sulphurous acid, and probably some sulphuric acid, when the gas is burned, which vitiate the atmosphere, and may even cause serious damage to books and silks, and other textile fabrics. Ammonia is objectionable because it attacks the fittings, corrodes the meters, and fixes the stop-cocks. It also has the property of holding tar in suspension. When burned it is partially converted into nitrous acid. Ammonia is, in some respects, advantageous; it unites with the sulphuric acid produced during combustion, and forms harmless sulphate of ammonia, and it is also said to prevent the deposition of naphthaline in the mains. The nitrogen and oxygen, which are generally present in the gas, are supposed to be entirely due to atmospheric air, which unavoidably gains admission when retorts are charged, purifiers changed, &c. Nitrogen diminishes slightly the illuminating power of the gas, as it absorbs a portion of the heat of combustion without contributing either heat or light. It may also form nitrous or nitric acid, and thus vitiate the atmosphere. Oxygen is more objectionable than nitrogen; it diminishes the illuminating power of the gas very materially. Carbonic acid also occasions a considerable loss of light; 1 per cent. of this gas is said to diminish the illuminating power of coal gas 5 per cent.

This table which I show you now, prepared by Firle, indicates the per centages of the impurities at different stages of the manufacture at Breslau:—

In the gas from—	Carbonic Acid.	Sulphuretted Hydrogen.	Ammonia.
1. The condenser	3·72	1·06	0·95
2. The scrubber	3·87	1·47	0·54
3. The washer	3·39	0·56	0·00
4. The Laming purifier	3·33	0·36	0·00
5. The lime purifier	0·41	0·00	0·00

A. Buhe (*Jour. für Gasbeleuchtung*, 1859, 420) has given more elaborate statements, among which are the following:—

Gas from Zwickau Coal.

In the gas from—	Carbonic Acid.	Sulphuretted Hydrogen.	Cyanogen.	Ammonia.
1. The hydraulic main	2·91	·23	·07	1·10
2. The condenser	3·88	·40	·07	·24
3. The scrubber	3·86	·44	·06	·15
4. The washer	3·64	·34	·09	·04
5. The purifiers	4·11	·00	·00	·00

Gas from Nettlesworth (England) Coal.

In the gas from—	Carbonic Acid.	Sulphuretted Hydrogen.	Ammonia.
1. The hydraulic main	1·10	·19	·70
2. The condenser	1·04	·09	·88
3. The scrubber	1·00	·10	·66
4. The washer	0·98	·01	·39
5. The purifiers	1·13	·00	·00

Methods of Purification.

There are four methods of purifying gas now in use:—

1. *The Wet Lime Process.*—This process involves passing the gas through milk of lime. It is the oldest process in use, and is very effective in removing both the sulphur compounds and the carbonic acid. It has been generally abandoned, however, on account of the difficulty of disposing of the foul milk of lime, called "blue billy." Occurring as a liquid, the "blue billy" is not easily transported; and as it does not rapidly undergo oxidation, it is not well adapted for use as a fertilizer. Running it into rivers and streams has been forbidden by law, as the pollution of the waters by it was intolerable; while the extremely offensive smell which it emits makes it impossible to store it until it becomes dry enough for transportation.

2. *The Dry Lime Process.*—In this process dry, or slightly moist hydrate of lime, is placed on trays in iron boxes, through which the gas is made to pass. This process is very effective, and has very generally superseded the wet lime process. It removes the sulphur compounds and the carbonic acid equally well. When the foul lime is removed, however, it evolves the same odour which caused the wet lime process to be abandoned. When exposed to the air it rapidly undergoes oxidation, becoming heated in consequence. During this process it evolves sulphide of ammonium, and some other compounds whose exact nature is not known, but whose odour is extremely offensive. This is the cause of the "gas nuisance" so loudly complained of a few years ago, when all the New York companies employed this process of purification. After the oxidation of the foul lime is completed, it ceases to be specially offensive, the peculiar stench being evolved during the first hour or two of exposure. The offensiveness of this foul lime became such a constant cause of complaint in the large cities of Europe, that the gas companies were compelled to abandon the process, as they had previously abandoned the wet lime. A system of ventilating the foul lime has been invented, and is now in use at both the stations of the Manhattan Company in New York, which effects its oxidation in such a manner that the offensive gases evolved are not permitted to escape into the atmosphere, but are passed through a washing apparatus, and finally through a special purifier, by which they are rendered comparatively inoffensive. This invention seems to obviate the nuisance of dry lime purification.

3. *The Laming Process.*—In 1849 Mr. Laming introduced the hydrated sesquioxide of iron as a substitute for lime for purifying gas, and prepared it of a suitable quality, by mixing copperas (sulphate of iron) with slaked lime and sawdust, and exposing the mixture to the air to oxidize the protoxide of iron to the sesquioxide. The resulting mixture contains hydrated sesquioxide of iron, sulphate of lime, and sawdust. When an excess of hydrate of lime is employed, the resulting mixture contains this substance also. This material is very effective in removing the sulphur compounds from the gas. There is, however, some difference of opinion as to the completeness with which the carbonic acid is removed, due, perhaps, to variations in the proportion of the ingredients. Two important advantages attend the use of this mixture—first, when fouled it does not evolve offensive odours on exposure to the air; second, by exposure to the air the sesquioxide of iron, which has been changed to sulphide of iron in the purifier, is regenerated, the sulphur being liberated and sesquioxide of iron again formed. The mixture may, therefore, be used again and again, till it becomes so clogged with the sulphur liberated, that it does not act promptly on the gas. It is then found to contain from 40 to 60 per cent. of sulphur, and may be used for the manufacture of sulphuric acid. I have seen mixtures which had been in use twelve months.

4. *The Iron Ore Process.*—A few months after Laming introduced the artificial sesquioxide of iron in France, Mr. F. C. Hills applied the natural hydrated sesquioxide of iron, or "bog iron ore," in England. This material, like the Laming mixture, may be used again and again, and does not evolve offensive odours when exposed to the air. A modification of this process is now used by the New York Gas Company. It was invented by Messrs. St. John and Cartwright, and has been in use nearly seven years, giving entire satisfaction. As the bog iron ores of this neighbourhood are not sufficiently pulverulent to act promptly on the gas, Messrs. St. John and Cartwright add to the ore a quantity of iron borings or turnings, which they then convert into an artificial hydrated sesquioxide of iron, moistening the whole with ammoniacal liquor, and exposing it to the air. The resulting mixture of natural and artificial oxide receives an addition of coarsely pulverized charcoal. This mixture is always sprinkled with ammoniacal water before it is placed in the purifier. In Germany several varieties of sesquioxide of iron are now in use, prominent among which are "the Oberuseler mixture," an iron ore containing some oxide of maganese; the "Mannheim oxide," and "Ecicke's oxide," very pure artificial oxides of iron.

Extent to which the different Methods of Purification are Employed.—The wet lime method has been almost entirely abandoned. The only works at which I know it to be used at present are at Cork, in Ireland. These works are of moderate size, and are situated out of the city. Moreover, the gas is freed from ammonia by means of sulphuric acid before it comes in contact with the lime. The foul lime does not, therefore, evolve sulphide of ammonium when exposed to the air. The dry lime process, though still in general use in this country, has been almost universally abandoned in Europe—abandoned, firstly, because the foul lime was an intolerable nuisance; second, because the process is too expensive, as the lime can be used but once, and when exhausted has but a trifling value as a fertilizer. The Laming mixture is now used in some of the European gas-works. All the gas supplied to Paris is purified by this material. The German gas engineers have found that this mixture owes its efficacy entirely to the oxide of iron, which it contains, and that the sulphate and hydrate of lime present do not take any appreciable part in the purification. Hence they are abandoning this mixture for the artificial oxides of iron, which are cheaper and more efficient. The iron ore method is now most generally used in Europe, and has obtained a foothold in this country, being used by the New York Gaslight Company, the Harlem Company, and several companies in Massachusetts and elsewhere. All the Liverpool gas, much, if not all the London gas, and that of most of the German cities, is now purified either by iron ore, or one of the artificial oxides of iron.

Comparative Advantages of the different Methods.—The lime methods effectually remove the carbonic acid, and reduce the sulphur compounds to a minimum. Where there are no objections to the use of dry lime on the score of cost or offensiveness, I think this agent would be generally preferred. Lime was first abandoned on account of the nuisance which it occasioned, but the iron oxides are now actually preferred by the European gas engineers on account of their greater economy. Mr. King, the engineer of the Liverpool works, assured me that the oxide of iron purification, which he had used exclusively for the past seven or eight years, costs less than half as much as the dry lime process used previously. Two objections are urged against the iron methods, by those who are prejudiced in favour of lime. First, they do not remove carbonic acid; second, it is claimed that they do not remove the sulphur compounds so completely as lime. The first is generally conceded to be true. But the only objection to carbonic acid is that it reduces the illuminating power of the gas; 1 per cent. of carbonic acid diminishes the illuminating power 5 per cent. The average quantity of carbonic acid is, say, 2½ per cent.; then the illuminating power of the gas will suffer to the extent of 12½ per cent., or one-eighth. There are two ways in which this difficulty can be effectually met, first, by using better coals for making the gas, or adding a few pounds of rich cannel or some other enriching material to the ordinary gas coals; or, secondly, by taking less gas from the coal. The last gas drawn from the coal is always inferior to that which comes off first. Mr. A. Buhe, already referred to, says: "It has become more and more the custom to leave the carbonic acid in the gas, and to neutralize its bad influence on the illuminating power by taking less gas from the coal, thus getting a better gas." Dr. Schilling says: "Carbonic acid is of no consequence to the consumer; cannel coal is the remedy." The second objection to the iron process is the alleged imperfect removal of the sulphur compounds. None of the methods in use entirely remove the sulphur from the gas. The question arises, therefore, how much sulphur can be safely left in the gas? The English Parliament has answered this question by fixing the limit at 20 grains of sulphur to the 100 cubic feet of gas; and to see that the companies come within this limit, chemists are appointed, whose duty it is to analyze the gas and report its quality. I have before me the report of Dr. Letheby for the months of January, February, and March, 1869. He states the grains of sulphur found in 100 cubic feet of gas to be as follows:—

	Max.	Min.	Average.
City of London Gaslight and Coke Company	18·92	11·70	15·00
The Gaslight and Coke Company	24·15	15·75	19·49
Great Central Gas Consumers Company	24·00	7·03	12·28

From this it will be seen that the gas of London, although purified by iron does not average 20 grains of sulphur in 100 cubic feet. With regard to the Paris gas, which is purified by Laming's oxide of iron mixture, Professor J. Lawrence Smith, one of the United States Commissioners to the French Exposition of 1867, and the president of the Louisville Gas Company, has given us a very decided opinion. On p. 88 of his report, which was published by the United States Government, he says: "The gas of these works is most thoroughly purified, and the dealers in silks and other delicate fabrics, who, a few years ago, always suffered more or less loss from the results of the combustion of impure gas acting on their fabrics, now no longer suffer from this cause." Dr. Letheby (JOURNAL OF GAS LIGHTING, 1869, p. 83) has argued that 20 grains of sulphur should not be left in the gas, and proposes, therefore, as the most effective method of purifying gas, this treatment: first, with ammoniacal liquor; second, with hydrated oxide of iron; third, with dry lime. As the iron will have removed the sulphuretted hydrogen, the refuse lime will not be offensive, while it will effectually remove the carbonic acid. This system of purification will, he thinks, reduce the quantity of sulphur to 10 or 12 grains per 100 cubic feet. Most gas engineers and chemists differ from Dr. Letheby on this point, however. Dr. Schilling says (in his *Journal für Gasbeleuchtung* for 1869, p. 484): "20 grains of sulphur in 100 cubic feet of gas are entirely unobjectionable. Under the most favourable circumstances, with no ventilation whatever, it would give the atmosphere of a room only one part of sulphurous acid in 500,000 parts of air." Professor Wm. Odling, secretary of the London Chemical Society, has spoken very clearly on this subject in his lecture to the British Association of Gas Managers, June 2, 1868, which appears in the JOURNAL OF GAS LIGHTING for 1869, p. 81, and I have found that his views are those generally entertained by chemists and gas engineers. He said: "I am altogether at issue with the public when they maintain that the sulphur of gas produces, by its combustion, oil of vitriol, or that the amount of sulphur ordinarily contained in gas is of any consequence whatever; and a little consideration will, I think, satisfy you of the soundness of this position. We will assume that coal gas contains, not 20, but 40 grains of sulphur in 100 feet—a quantity, at any rate, greatly exceeding the reality. Now, making another extravagant assumption, that the whole of these 40 grains of sulphur would be completely burned—and in reality they would be burned very incompletely—they would furnish, by their combustion, 80 grains of sulphurous acid gas. This quantity of the produced sulphurous acid would occupy at ordinary temperatures about 1-15th part of a cubic foot; and since 100 cubic feet of our coal gas give 1-15th of a cubic foot of sulphurous acid, 1500 cubic feet of coal gas would be required to furnish one cubic foot of the acid, even upon the extravagant assumptions we have purposely made. But the combustion of 1500 feet of coal gas would produce something besides sulphurous acid. It would produce at least 1000 cubic feet of carbonic acid, and, in addition to its dilution by other gases and vapours, we should have our sulphurous acid diluted by 1000 times its volume of carbonic acid. Now, if we can get at the proportion of carbonic acid in the atmosphere of a room highly illuminated with gas, and take the 1-1000th part of that proportion, we shall be able to form some notion of the amount of sulphurous acid present. You will remember that the amount of carbonic acid furnished by the breath of one individual is equal to that furnished by two 3-feet gas-burners, and that the maximum amount of carbonic acid found in the atmosphere of a crowded theatre was 0·32 per cent. Now, if in addition to our previous unreasonable suppositions, we further suppose that an atmosphere contains 0·2 per cent. of carbonic acid furnished by gas combustion, you will see that the whole matter becomes a *reductio ad absurdum*—that we might actually have one half-millionth part of sulphurous acid present in the air of a gas-lighted room." The facts and opinions here quoted effectually dispose of the second objection to oxide of iron purification.

Composition of the Purified Gas.—The following table shows the per centage composition of the purified coal gas, as it is delivered to consumers:—

	Heidelberg.	Bonn.	Chemnitz.	London. Common.	London. Cannel.
Hydrogen	44·00	39·80	51·29	46·00	27·70
Marsh gas	38·40	43·12	36·45	39·50	50·00
Carbonic oxide	5·73	4·66	4·45	7·50	6·80
Olefiant gas, and other hydrocarbons	7·27	4·75	4·91	3·80	13·00
Nitrogen	4·23	4·65	1·41	0·50	0·40
Oxygen	..	..	0·41	..	..
Carbonic acid	0·37	3·02	1·08	0·70	0·10
Aqueous vapour	..	..	..	2·00	2·00

The difference in the per centages of carbonic acid is largely due to the method of purification. When lime is used, nearly all of this gas is removed, otherwise not. As the specific gravity or density of the hydrogen and marsh gas is much less than that of olefiant gas and the rich hydrocarbon vapours, the specific gravity of the gas made from the same coal is a tolerably accurate measure of its richness in illuminating constituents. The specific gravity of air is taken at unity (1·000); hydrogen is 0·0691; marsh gas, 0·5594; carbonic

oxide, 0·9727; olefiant gas, 0·976; propene, 1·490; butene, 1·940; benzole, and the other rich vapours, much higher. Hughes, in his Treatise on Gas-Works, gives the following estimate of the specific gravities of gas of different illuminating powers:—12-candle gas, ·400; 14-candle, ·425; 16-candle, ·450; 18-candle, ·475; 20-candle, ·500, &c. This would not be even approximate for gas containing much carbonic oxide, as that prepared by the aid of steam. Mr. W. W. Goodwin, of Philadelphia, now supplies a beautiful and simple piece of apparatus by which the specific gravity of the gas can be accurately determined in a few minutes.

As it is sometimes desirable to estimate the yield of gas from coals in per centages by weight, the following data will be useful:—1, the specific gravity is the ratio of weight compared to that of air as a unit; 2, 1000 cubic feet of air weigh 76·708 lbs. avoirdupois; 3, multiply 76·708 by the specific gravity, and the product is the weight of 100 cubic feet of the gas. Hydrogen has a specific gravity of ·0691; 76·708 × ·0691 = 5·30 lbs.; marsh gas = specific gravity ·5594; 1000 cubic feet weigh 42·91 lbs.; 1000 cubic feet carbonic oxide, specific gravity ·9727 = 74·61 lbs.; 1000 cubic feet olefiant gas, specific gravity, ·976 = 74·86 lbs.

Before leaving the subject of the composition of gas, I desire to call your attention to this simple terrace of burners. The upper row of burners shows you the flames of pure hydrogen, which are so low in illuminating power that you can hardly see them. The second row is supplied with marsh gas; you see that the flames are yellow, but that they emit very little light. The third row presents the carbonic oxide flames which are of a livid blue, like the flames of this same gas which often flit across our anthracite fires. What a contrast is presented by the lower row of burners, from which the olefiant gas issues. That this gas is the source of the illuminating power, and that hydrogen, marsh gas, and carbonic oxide are mere diluents, you can no longer doubt

Mains.

In the distribution of gas, a certain per centage of leakage is unavoidable, but this can be reduced to a minimum by the exercise of a little care. The best plan is to test each length of pipe by closing one end with a plug, connecting the other end with a small forcing air-pump, such as is used by gas-fitters, and while the pipe is immersed in water forcing air into it. Bubbles of air passing the pipe will reveal every imperfection in the metal.

The location of each leak can be recorded by making a circle round it with chalk. Small holes can be closed by hammering the metal together; if large holes are detected, the pipe should be rejected. Immersing the pipes in hot coal tar is a very effective preventive of leakage. Leakage is said to often amount to 16 per cent. of all the gas produced, or even more; by the above-mentioned precautions it may be reduced to 2 per cent. As there is always a certain condensation of water and oily or tarry matter in the mains, receivers or wells are constructed at convenient points, and the mains are laid inclining towards them. From time to time the condensed liquids are pumped out of the wells into a portable tank, and thrown into the tar well at the works. Complaint is sometimes made of an excessive condensation of naphthaline in crystals or crusts, which seriously diminish the capacity of the pipes. According to Professor J. L. Smith, bituminized-iron pipe is extensively used for gas in France. It is made from 1¼ inch to 28 inches in diameter. The base of the pipe is sheet iron, leaded, varying in thickness according to the required size and pressure; each section of pipe is made of two sheet, that are first rivetted together separately with tinned rivets, and plunged into a bath of melted lead; these two pieces of pipe are then rivetted together, and the junction of the two well tinned. The entire pipe is now 13 feet long. On the ends are convenient sockets and spigots, made of a mixture of lead and antimony, which serves to unite the sections of pipe when laid in the ground. The exterior surface of the pipe is coated with tar, and around this is wrapped a cord; this cord is then covered with melted pitch, and the pipe then rolled in coarse sand until it has acquired a thickness of from one-fourth to five-eighths of an inch. Chameroy and Co., of Paris, manufactured between the years 1838 and 1867, of this pipe for gas, 3160 miles; for water, 897 miles—of a total value of 7,708,400 dols.

The Meters.

Nothing is so mysterious to the gas consumer as the meter, and yet, as a matter of fact, the meter is quite as accurate as any other measure in use. It does sometimes err, but its errors are almost always in favour of the consumer and against the companies. It cannot measure gas that does not pass through it, but it permits gas to pass through without registering the quantity.

It is unnecessary to explain the construction or working of the meter to this audience. I will say, however, that the measurement of gas presents difficulties not encountered in any other case. The gas must be measured while in actual use, as no system of measurement and storeage would be practical. Its flow must not be interrupted in the slightest degree, as otherwise the lights would be extinguished, or at least be made to flicker in a manner that would be unendurable, and while its flow is uninterrupted, its volume must be accurately recorded.

Comparative Advantages of Wet and Dry Meters.

Wet meters being simpler in construction, composed entirely of metal, and having no valves except the float, are most durable and less likely to get out of order. They are, however, liable to stop from freezing, from too much or too little water, and from sending moisture into the pipes. They also register vapour of water as gas, though the quantity is too small to be of any consequence. The dry meter is not liable to any of these objections, but being more complicated and more delicate, it is more liable to wear and get out of order. The inaccuracies which result from wear or corrosion are generally in favour of the consumer, as gas leaks from one space to another and escapes being measured. The dry meter is now more generally used.

The accuracy of the meters is very often questioned by the consumers. The resemblance of the dials leads them to infer that, like clocks, the meters may run fast or slow. But the case is not parallel; the meter is an engine in which the gas is the motive power, and unless the gas passes through the meter, it cannot move. On its dials are faithfully recorded the number of its revolution in cubic feet. All waste and leakage is recorded, as well as the useful consumption. Some think that the increased pressure makes the meter spin round faster, and record against the consumer; but if he regulates the burners so as to prevent "blowing," he at once neutralizes the effect of the increased pressure. From the nature of things, the injury which the meter suffers in use must generally be against the company. If a valve leaks, or a rust-hole occurs in the measuring-drum, or a crack in the leather, gas gets through without being recorded. Sometimes the valves of a dry meter become fixed in such a position as to let the gas through without moving. The meters are all tested by State inspectors, by passing a certain number of cubic feet through each, and noting whether it is properly recorded on the dials. In New York and Massachusetts, a meter is stamped correct when it varies less than 2 per cent.; in Ohio the tolerance is 3 per cent. Professor Wormley, State inspector for Ohio, in testing 2321 new meters, found only 13 that varied over one-half of 1 per cent. Mr. Stimpson, State inspector in Massachusetts, in one year tested 11,316 meters; only 148 failed to come within the requirements of the law. Very few of these varied 5 per cent.; 62 averaged 8·47 per cent. against the companies; and 85 averaged 4·5 per cent. short.

Burners.

Far too little attention is paid to the character of the burners. There are three forms of burner in common use—the bat's-wing or slit burner, the fish-tail, and the Argand.

The amount of light produced by a given gas varies enormously with the conditions under which it is burned. The maximum amount of light is obtained by burning it on the verge of smoking; while in the Bunsen burner, used for heating purposes in chemical laboratories, the flame is blue and non-luminous. The loss of light is due to a too rapid mixing or contact of the gas with the air. This is controlled by the size and shape of the holes in the burner, the height of the chimney, and the distribution of the air (in the Argand), and in all cases by the pressure. The holes and slits for rich gas should be small, as such gas requires more air than poor gas. Under the same pressure, a burner which consumes 4 feet of gas per hour gives more light than two burners consuming each 2 feet. There is no economy of light in small burners. The pressure of the gas is a most important consideration. Argands give most light under a pressure of 1-10th of an inch; bat's-wings and fishtails under a pressure of 3-10ths to 4-10ths of an inch. As gas is supplied to consumers under pressure varying from 3 or 4 inches down to 1-10th, it is very desirable to check the flow when it is excessive. This can be done by the use of regulators, by turning the gas off at the meter, by partly closing the cocks on the fixtures, or by introducing a check into the burner. Check-burners should always be used; they are constructed in various ways—always by placing some obstruction in the way of the gas to retard its escape. A very simple plan is to screw a 5 or 6 feet burner over a 3 or 4 feet burner. With regard to a choice of form, the Argand is best for ordinary gas as it gives a very steady flame, and consumes the gas to the best advantage.

Bat's-wing burners cannot be used in globes or shades, as the flame is so broad as to crack the glass; fishtails, or the peculiar form of bat's-wing burner known as having the "excavated head," must be employed. The material of which the burner is constructed is a matter of great importance; iron rusts, and the size and form of the openings become considerably modified in consequence; brass is better, but the best material is soapstone, usually called "lava." The best burner is Sugg's "London" burner, a lava Argand. The best burner to be had in this country is Gleason's noiseless Argand, of brass, provided with a regulator, which serves as a check. Most of the "patent burners" possess very little value—the merit generally consists in a check of some kind; none of them are equal to the properly constructed lava-tipped bat's-wings, fishtails, and Argands, provided with simple checks. Some of you remember the monstrous swindle which was attempted, a few years ago, in this city with the Cremin burner. It was proposed to place this patent burner, together with a tin reflector, the whole costing, perhaps, 1½ dol., on every public lamp, at a cost to the city of 15 dols. each. As there are about 20,000 street lights, the swindle would have cost the city 300,000 dols., without furnishing any additional light. The head of the department of Public Works at that time, Mr. Tweed, refused to countenance such a fraud, and the scheme failed in consequence.

The gas referees of London made a report in 1871 on the subject of burners, in which some points are established which are of great importance. They found that, by using good burners instead of bad ones, consumers may obtain from 30 to 50 per cent. more light, while their gas bills remain the same. The improvement of burners is important as a sanitary reform, as in furnishing the same quantity of light, the good burner will consume less gas, and, consequently, air, and will produce a smaller quantity of the products of combustion, and less heat than a poor burner. Burners from two newspaper offices gave only half the illuminating power of the gas, while several of the burners tested gave only one quarter the proper light of the gas.

These facts, and many others which came to their knowledge, proved to the referees that "an enormous waste of gas prevails, with a corresponding pecuniary loss to the public."

London pays 10 million dollars per annum for gas, and the referees believe that one-fourth this sum may be saved by the use of good burners.

The best burner yet constructed is Sugg's "London" burner (Argand, lava). Calling the illuminating power of its flame, when consuming 5 feet of 15-candle gas per hour, 100, the following were the best results obtained from several burners:—

	Pressure. Inches.	Consumption of Gas per Hour.	Illuminating Power. Sugg's London, No. 1, at 5 Ft. = 100.	Illuminating Power. Calculated to a Consumption of 5 Ft.
Fishtail Burners.				
No. 1.	0·2	1·7	12·2	36·0
No. 2.	0·3	3·1	38·4	62·0
No. 3.	0·45	3·3	34·3	52·0
No. 4.	0·17	2·0	18·8	47·0
No. 5.	0·5	1·8	6·8	19·0
Bat's-wing Burners.				
No. 7.	0·3	5·0	86·5	86·5
No. 8.	0·3	4·9	75·6	82·2
Argand Burners.				
No. 9. Sugg's London No. 1	0·218	5·0	100·0	100·0
No. 10. Common	0·22	5·6	89·1	78·8
No. 11. „	0·78	5·8	90·6	77·4
No. 12. „	0·6	5·2	34·7	34·3

It is thus seen that the six bat's-wing burners tested, burned under the most favourable pressures for each, gave only from 19 to 62 per cent. as much light as Sugg's "London" burner, for the same consumption of gas, 5 feet per hour; the two bat's-wing burners from 82·2 to 86·5 per cent., and the three Argands from 34·3 to 78·8 per cent.

(*To be continued.*)

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

There has been no movement worthy of being specially noted in any single department of the local and district iron trades during the week which has elapsed since the date of my last report. In pig iron there have been several fairly good transactions, but prices have not been quite so stiff as during the preceding week or ten days. Foundry pig irons still continue to be in most general request, forge qualities being much neglected, owing to the current stagnation of the finished iron trade. Some of the local agents are disposed to ask rather more money for futures; but, on the average, the following are the figures quoted by agents of North Yorkshire houses:—No. 1 foundry, 57s.; No. 2 foundry, 55s.; No. 3 foundry, 53s.; No. 4 foundry, 52s.; No. 5 forge, grey, 51s. 6d.; No. 5 forge, mottled, 51s. 6d.; No. 6 forge, white, 50s.; refined metal, 73s.; Kentledge, 61s.; and cinder pig, 40s., all per ton for net cash, in railway waggons or f.o.b. A reliable Derbyshire No. 3 foundry pig is selling at about 65s. to 66s., and Yorkshire Thornaby is quoted about 63s. to 64s.

Some of the foundry establishments are enjoying a fair amount of prosperity, but it is well understood that they are working out orders for special colliery requirements, or are clearing off orders which had been placed on their books prior to the Christmas holidays. As I stated a few weeks ago, the brass manufacturers are not so busy just now, but in one or two special cases I still continue to hear of good gas and water works orders being placed. The local coal trade is good, but not up to the customary activity of this period of the year. The house coal traffic is large to London, but I do not hear that the demand for steam coal is at all large or regular. The shipments from the port of Hull, in

1875, were hardly in excess of those for 1874—amounting to about 468,000 tons actually exported. Trouble is threatening the South Yorkshire Miners Association. A document issued on Saturday by one of the secretaries, Mr. Casey, states that the association has never been in so perilous a position. There are about 17,000 members.

IRON AND COAL TRADES OF SOUTH STAFFORDSHIRE AND EAST WORCESTERSHIRE.

(FROM OUR OWN CORRESPONDENT.)

There has been rather more activity noticeable at the mills and forges throughout the district since quarter-day, and the producers of the better qualities of iron are now reported to be fairly well employed; but the makers of the common qualities still suffer seriously by the keen competition of the north country districts, and prices are consequently rather weak. Unmarked bars are still quoted £8 per ton, and sheets vary from £11 to £13 per ton, according to quality; sheets of known brands are in good request, and galvanized roofing sheets are in demand, chiefly on account of the Australian market. Hoops and nail-making iron also continue in prominent inquiry. Bars of best brands are firm at £9 10s. to £10 per ton, and the general trade appears to have been benefited by the comparative firmness of current rates. Makers are now sanguine of a revival of the shipping trade as soon as the northern ports are accessible. In pig iron the market is quiet, but steady, and stocks have been considerably reduced by the orders placed on quarter-day. Production is still restricted, and not likely to be increased at present.

The arrangements connected with the formation of the new Conciliation Board, referred to in last report, are now progressing satisfactorily, and there is every prospect of an early adoption of the scheme.

The coal trade is not quite so active as recently reported. Supplies are considerably more abundant; but, at present, prices are not quotably lower, though underselling is on the increase. The new pits of the Cannock and Wimblebury Colliery Company are now in full operation; and the Cannock Chase firms are, to some extent, adversely affected by the increased output of fuel in that district. The demand for household qualities being, as usual, rather slacker since the Christmas holidays, but the colliers readily find full employment, and stocks have not yet increased to any noteworthy extent.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The coal trade of this district is in a very depressed condition, and, although there has been no alteration in the list rates, there is less firmness in prices generally. For house coal the demand has fallen off considerably since the breaking up of the frost, and supplies are now rather in excess of requirements. In the better classes of furnace and engine fuel a moderate trade is being done, but inferior sorts are very plentiful in the market, and concessions in price have been necessary to keep trade together, as there is a good deal of competition for orders. The average pit prices in the Wigan district range about 13s. to 13s. 6d. per ton for Arley, 11s. 6d. to 12s. for Pemberton four-feet, 9s. to 9s. 6d. for common coal, 6s. to 6s. 6d. for burgy, and about 4s. 6d. for good slack; but common sorts are offering at 3s. per ton.

There are a few inquiries for gas coal from consumers who have not fully covered their requirements, but the demand is chiefly on account of old contracts, and pit prices in the Manchester district range about 12s. to 14s. for best screened, about 11s. for unscreened, 12s. to 14s. for cannel nuts, and 9s. to 10s. per ton for ordinary nuts.

The coke trade is very quiet, and must remain so as long as the depression in the iron trade continues. Best Durham foundry cokes, delivered into the Manchester district, are offering at 24s. 6d. per ton; but the best local makes can be bought at 22s. to 24s. per ton, and inferior sorts at about 17s. per ton.

In the iron trade of this district there has been very little doing, and prices generally are weaker, as compared with what they were a week ago. Lancashire makers of pig iron have been endeavouring to obtain an advance of 2s. 6d. per ton, but they have been unable to secure business at the advanced prices, and Middlesbrough iron offering in this district has exhibited a downward tendency. The prices quoted are variable, and the business doing is so small that actual values can scarcely be arrived at. In manufactured iron, quotations remain without much change, ordinary bars delivered into this district being quoted at £7 15s. to £7 17s. 6d. per ton; ship plates at £8 15s. 2d.; boiler plates at £9 15s. per ton; angles are quoted at £8 15s. 2d.; puddled bars and billets at £5 15s. per ton.

Furnace proprietors are still working only half their plant, and the finished iron establishments are short of orders. For builders castings there is a fair demand, but the general foundry trade is quiet, and with the exception of cotton machinists, engineers have little on hand.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The coal trade of the North of England is a little unsettled just now. Shippers hardly know what to do in the way of entering upon new business, until the awards of the arbitrators are known. The decision in the Northumberland steam coal trade will probably be known this week, and in the Durham coal trade next week. In the meantime, a paragraph has appeared in the local papers purporting to give a copy of a notice which has been served upon the men in several collieries in the county of Durham, of a further reduction of 20 per cent., or as near as may be, on all prices and rates. If this report is authentic, it would appear as if certain collieries in the second-class coal trade will not abide by the award, whatever it may be, but will strike out an independent line of action for themselves. If that were so, it would greatly complicate matters. At present an active business is being done at, say, about a dozen of the first-class collieries shipping on the Tyne, and employing their own steamers, and terms for sailing vessels are somewhat long. A comparatively dull business, however, is done at second-class gas pits, and turns are very much shorter with them. The quotations for single cargoes of very best gas coals are from about 11s. to 12s. 6d. per ton, whereas for second-class sorts the range is from 10s. to 8s., and for inferior qualities a shade lower than that. One of the leading collieries in the steam coal trade reduced their prices for best sorts to 12s. 6d. per ton last week, and it is pretty certain that that will be the official quotation for best steam coals on the 1st of February. Household coals range from 11s. to 14s. per ton, and manufacturing coals are all prices.

There is a complete glut of steamers seeking employment in the coasting trade. On Friday a boat was fixed for three voyages at 4s. 6d. per ton to London, which is remarkably low, and other trades open to steamers show a proportionately low rate of freight. The fall upon sailing freight in the coasting trade has been from threepence to sixpence per ton. Coasting orders are now somewhat scarce, and a comparatively dull business was transacted last week. The quotations are likely to favour the shippers for the remainder of the month.

The award made in the iron trade last week by Messrs. Mundella and Williams, the arbitrators appointed to decide upon the extent of the reduction of ironworkers wages, was declared last week. It gave considerable dissatisfaction to a large body of the men, apparently, who have threatened to resist it, and the iron trade is a little unsettled. Prices are unchanged, and a moderate amount of business was done last week. The chemical and general manufacturing trade of the Tyne is only dull. There are not many orders to hand, and the business of the month so far has been comparatively limited. It has not come up to the expectations of the opening of the year.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The gas now being supplied to the people of Kilmarnock by the Gas Corporation of that town may not be the very best made in Scotland, but it certainly has a very high illuminating power. Recent testings at the police office gave 29¼ standard candles as the maximum, and 28 candles as the minimum, the average being 28½ candles.

Again has the question of police-constables having to extinguish street-lamps cropped up in Scotland. On this occasion it is the royal burgh of Renfrew in which the grievance has shown itself or been complained of. At the last meeting of the Town Council a communication was read from the police-constables, stating that they felt it a grievance to have to extinguish the street-lamps. Such work, they said, had been decided by Mr. Carnegie, the Inspector-General of Police in Scotland, not to be police duty, in the cases both of Aberdeen and Hawick. It was agreed to take no notice of the letter, inasmuch as what might be a grievance in large towns was not so in such a limited burgh as Renfrew. If the Government grant (£180) were refused on such a paltry ground, it would be time enough then to consider the matter.

A meeting of what was once the Thurso Gas Company was recently held, when it was agreed to intimate to the lessees of the gas-works that they would require to reduce the price of the gas supplied by them to the town from 12s. to 7s. 6d. per 1000 cubic feet, as stipulated in their agreement with the gas company.

A graceful act has just been done by the Nairn Gaslight Company. In recognition of the successful manner in which he managed the affairs of the old gas company, they have presented Provost Leslie, the chairman of that company, with a handsome ornamental lamp, which they have erected at the entrance to his house, the gas consumed by it being supplied free. Provost Leslie continues to take an active interest in the prosperity of the new company.

The lecture by Mr. B. M. M'Crae, gas manager, Dundee, on "The Economic Use of Coal Gas for Lighting Purposes," was delivered on Wednesday evening, before a large audience, and was a very marked success. As you may feel disposed to give a more detailed notice of the lecture than would be possible in these Notes, I need not refer to it any further than to urge upon gas managers and gas analysts in other towns to follow such an excellent example as has now been set them by Mr. M'Crae. I do not forget the fact that a very excellent lecture on the same subject was delivered three or four years ago in Glasgow, by Dr. Wallace, who is the gas examiner for the city; but it differed from Mr. M'Crae's in this respect—namely, that it was delivered before a very select audience—the members of the Philosophical Society, and not before the public at large. It must be borne in mind, however, that the citizens of Dundee are very democratic in their notions.

Before leaving Dundee, I ought to mention that, at the last meeting of the Police Commission of that town, a report was submitted from the Lighting Committee, to the effect that the testing apparatus at the Police Buildings was worn and insufficient, and that instructions were given to provide other suitable apparatus; so that the previous instructions with regard to the testing of the gas supplied by the Corporation Gas Commission, might be carried out.

A meeting of the Town Council of Edinburgh was held last Tuesday, when, among other things, it was reported that the gas supplied to the city, on the 7th inst., by the Edinburgh Gas Company had an illuminating power of 27·20 candles, and that supplied by the Edinburgh and Leith Company had an illuminating power of 26·4 candles.

The Forfar Corporation Gas Commission have just had a memorial presented to them from the Kirk session of one of the Free Churches of that town, on the subject of Sunday labour at the gas-works. The memorial spoke of the gas stokers being unable to attend any place of worship on Sundays, which was a system that no public body should encourage, far less adopt; and it urged that some remedy should be applied which would not entail a reduction of wages. In a discussion which arose on the subject it was stated that the men had made no complaint to the manager regarding their hours of labour, and that the system now in operation had been adopted at their own suggestion. When they wanted an increase of wages they sought it themselves; and it was urged by one of the speakers that the men did not require the reverend gentleman who presented the memorial, or any one else, to complain on their behalf. The matter was remitted to the Gas Committee for their consideration.

The new Water Bill, promoted by the Edinburgh and District Water Trust, is now practically secure against any danger from opposition, no memorials against it, in reference to the Standing Orders, having been presented within the proper time. It will accordingly pass as an unopposed measure.

An intimation has been received by the Crieff local authority, from the Public Works Loan Commissioners, announcing their willingness to lend the sum of £3500, to carry out the proposed drainage of the burgh; but they refuse to grant £4500 for the water-works, on the ground that they are not in the practice of lending money to pay off debt already incurred.

At the last monthly meeting of the Greenock Water Trust, it was reported that the supply of water in store in the reservoirs on the 1st inst. was 510 million cubic feet, or 145 days supply for all purposes; and that the rainfall during 1875 was 61·73 inches, or a little above the average rainfall for the district.

Thirty acres of ground to the west of Kennoway are to be occupied as gathering-ponds for the Buckhaven New Water-Works. Operations in connexion with the works for an increased water supply are to be commenced next month.

Fearing that Sir John Hawkshaw might recommend a scheme for purifying the Clyde by conveying the sewage of Glasgow to the sea upon the Ayrshire coast, the Earl of Eglinton and other landed proprietors and the magistrates of Irvine and Ardrossan have already taken action with the view of opposing any such scheme. They held a meeting on Thursday, and resolved to send a minute of their proceedings to Sir John Hawkshaw.

The Glasgow pig iron market has been somewhat depressed during the past few days, and business has been done at as low as 63s. to 63s. 3d. cash; but at the close on Friday afternoon there was an improvement, 63s. 6d. cash being paid, with buyers over.

Except as regards house descriptions, the Glasgow coal market has been somewhat stationary during the past week. House coal has become rather difficult of sale, owing to the mildness of the winter. The shipping trade does not show any great activity, and forward orders are scarce. Prices have a tendency to be lower, notwithstanding the determination of some of the miners to strike for an advance of wages.

MANCHESTER CORPORATION NEW GAS-WORKS.—The Gas Committee of the Manchester Corporation are offering premiums for plans of additional gas-works, to be erected on land near Bradford Road, Manchester. The three plans selected will receive premiums of £500, £300, and £200. The plans are to be sent to Mr. T. Peacock, Gas Office, New Town Hall, Manchester, by the 21st of March next.

MASTIC FOR THE JOINTS OF GAS-PIPES, &c.—The following is a recipe for the preparation of a mastic for making the joints of gas and cold-water pipes glazing purposes, &c.:—Mix 3 kilogrammes (6·6lb.) of very fine sand, 3 kilogrammes of pounded chalk, and half a kilogramme (1·1lb.) of white lead. Mix into a paste, and dilute it with linseed oil. Should the mastic become hard through cold, it will only require warming a little.—*Le Gaz.*

SPONTANEOUS COMBUSTION OF COAL.—A pneumatic thermometer, possessing the property of indicating the existence of too great a degree of heat in coals stacked on shipboard, has been invented by an inhabitant of San Francisco.

The instrument has been described as a simple cylinder of copper, at the lower end of which there is a moderately thick diaphragm of india-rubber, which closes itself hermetically; at the upper end is a metallic cover, having an opening sufficiently large to allow of the insertion of an iron pipe. Upon the india-rubber diaphragm rests a thin metallic rod, communicating, by means of the iron pipe, with a base-plate, upon which is traced a dial marking the degrees of heat. Should there be a development of heat in the hold of the vessel where the coals are stowed, the air in the cylinder will immediately expand; this causes the india-rubber diaphragm to swell, and give motion to the metallic rod communicating with the indicator of the dial, and thus the exact degree of heat existing in the bulk of coals is arrived at. It is reported that the instrument has been tried by competent persons in San Francisco, and if it possess the properties attributed to it, there is no doubt it will be also employed elsewhere.

Explosion of Gas at Jarrow.—On Saturday evening the 15th of January a disastrous explosion of gas took place in Christ Church, Jarrow, a comparatively new building. It appears there was a smell of gas during the afternoon, but it was not felt so much in the evening. Between seven and eight o'clock, Mr. Cross, the church-keeper, lighted a jet in the cellar, while his wife and Mr. Allen, one of the churchwardens, were in the vestry, in which is lodged the meter which supplies the entire building with gas. In a few minutes a terrific explosion took place, which blew the roof off the vestry, the slates and rafters being strewn about the plot of ground which surrounds the church. These the blast took a southerly direction, and this, perhaps, explains the reason that the occupants of the vestry were not killed on the spot. Both were very much stunned by the shock; and Mr. Allen got a slight wound on the back of his head, and Mrs. Cross's hair was singed. The windows and doors of the vestry were also smashed so pieces, but the only damage to the church is the displacement of a portion of the roof of one of the aisles. Most of the houses have sustained considerable damage to the windows. It is believed that there must have been a large accumulation of gas in the roof of the vestry.—*Newcastle Chronicle.*

Fatal Accident to a Travelling Gas-Fitter.—On the 18th inst., Dr. Hardwicke held an inquest at Paddington, as to the death of Thomas Jefferson, aged 38. Deceased was a gas-fitter in the employ of the Great Western Company, and his duty was to travel about in the trains and see that the gas supply and the gasholders in the carriages were in proper order. On the 8th inst., at the Bishop's Road Station of the Metropolitan Underground Railway, deceased got into a carriage of a Windsor train, and found the gas lights flickering. He tried to remove the glass, but being unable to do so, opened the carriage door and got out on the roof. The door, which was left open, struck against something in the tunnel and was smashed. Almost immediately after a loud report was heard, and the lights went out. Afterwards deceased was found on the line. The regulations strictly prohibited getting out of a carriage to attend to the gasholders whilst the trains were in motion, but deceased, who was wonderfully agile as well as zealous, had done so before. He was removed to St. Mary's Hospital with a fractured skull, both arms much shattered, cuts on the face and hands, and other injuries. He was only occasionally sensible, and died on the 14th from injury to the brain by fracture of the skull. Verdict—"Accidental death."

Gas Explosion at Rochester.—On the morning of the 17th inst. an explosion of gas took place at the Gundulph Tavern, High Street, Rochester. It appears that Mr. Boulden, the landlord, upon coming downstairs in the morning, had his attention drawn to the front parlour of the house, from the strong smell of gas, and proceeded to inspect the burners and pipes; having discovered that the supply of water in the gas-pendant was short, he was in the act of refilling the pendant when the light, which he had taken into the room with him, caused the large quantity of gas which had escaped from the upper part of the pendant, to explode. So great was the force of the explosion that a two-inch door was broken in halves, the lock and hinges forced off another door and broken into pieces. The parlour window, and the plate-glass front doors were blown completely out. Mr. Boulden received a severe shock, and was seriously bruised in the face and on the head, and as soon as assistance was at hand he was conveyed to his bed-room. Mr. A. Ransom, coal merchant, happening to be passing the house at the time of the explosion, was blown nearly to the other side of the road by the force of gas, receiving a severe cut with the glass.

Gas Explosion at Bradford.—Last Wednesday morning, about half-past eight, an explosion of gas occurred at a new warehouse erected at the corner of Garnett Street and Joseph Street, Leeds Road. The building is four storeys in height, and the workmen engaged in completing the interior had smelt gas. It was conjectured that the escape was from a pipe in the second story. A gas-fitter went into this room in the morning to ascertain whether or not the gas escaped there, and had in his hand a lighted candle. A loud explosion followed, which was heard some distance. Some of the ceiling boards were displaced, the glass in the windows and some of the frames were broken, and the windows of the New Inn, on the opposite side of the street, also suffered, the streets being powdered with fragments of glass. The gas-fitter was knocked down by the explosion, but his presence of mind did not desert him. He sprang to his feet, ran to the meter, and turned off the gas—probably averting a second explosion and more serious disaster. The damage was upwards of £50.—There was also an explosion of gas on the previous Monday, at the residence of Mr. F. A. Greenwood, of the Bank Foot Mills, top of Manchester Road, Bradford, by which considerable damage was done to a sitting-room; one window was blown out, other windows broken, the furniture injured, and the servant, who went into the room with a light, was thrown down and very much alarmed.

Register of New Patents.

568.—Outerson, J., and A., Windsor Locks, Hartford, U.S.A., "*An improved filter.*" Patent dated Feb. 16, 1875.

This invention relates to a filter for water and other liquids that do not act distructively on any material. The medium used is disintegrated paper stock washed clean, preferably made by cutting, boiling, washing, and bleaching rags, though other material, as jute, flax, hemp, rope, and the like, can be used. This is put into a vessel with a strainer bottom and the water run through it, there being a ledge or shelf all round the inside of the vessel to catch any sand or grit which may work down at the sides.

573.—Hallsworth, S., Armley, and Bailes, R., Woodhouse Carr, near Leeds, "*Improvements in the method or means employed in treating and clarifying sewage or other impure waters.*" Patent dated Feb. 17, 1875.

In carrying out these improvements two mixtures are formed. The first consists of copperas, dry copperas, copperas bottoms, copperas sediment, the sediment that subsides from the manufacture of nitrate of iron, the spent residue of iron pyrites, also spent pyrites. The second mixture is spent residue of iron pyrites, iron ore or slag saturated with liquor from beds of iron pyrites at copperas works, or with diluted sulphuric or muriatic or diluted nitric acid.

The sewage or other matter is run into a tank, to which is added slaked lime or gas lime, clarifying mixture No. 1 or mixture No. 2; the whole is agitated, allowed to settle, and the pure water run off.

590.—Peacock, J. C., Bloomsbury, and Rudkin, T., Smithfield, "*Improvements in apparatus for cooking and boiling by means of gas.*" Patent dated Feb. 18, 1875.

This invention consists of improvements upon an invention described in the specification of a patent granted to one of the present inventors in 1874, No. 1065, for gas ovens or roasters. As then constructed, these gas ovens or roasters consisted of a chamber suitably arranged, and fitted and surrounded with non-conducting material. Within the chamber at one end, and near the bottom is a gas-burner supplied with air through openings. The quantity of air thus admitted into the chamber to the burner can be regulated by a valve. The outlet for the products of combustion is at the lower part of the chamber into a flue-pipe, in which there is a regulating valve or damper.

According to the present invention the products of combustion are still drawn from the lower part of the chamber, but they are conveyed to the top of the chamber, and so into the flue-pipe, by a channel, which is separated from the cooking space only by a partition of thin metal which readily conducts heat, so that when the gas is first lighted the air in the channel is at once heated by conduction through the metal partition, and thus the draught is started much sooner than it would be if dependent on heated air entering the channel and flue from the bottom of the chamber. The partition by preference should expose a considerable extent of conducting and heating surface, and it may be arranged in different forms. A flat partition fixed at a short distance from the end of the chamber is a simple and efficient arrangement, but an oval tube or a series of tubes has the advantage of exposing a larger surface. The bottom of the chamber is made without any non-conducting material, and there is formed upon it a box of sheet iron, into which plates and dishes may be placed to warm; the top of this box, in fact, forms the bottom of the cooking space, and both the gas-burner and the outlet for the products of combustion are below it. Over the gas-burner and near the top of the chamber is fixed a curved plate to direct the ascending current of hot air along the top of the chamber, and so obtain a more regular circulation of the hot air.

594.—Atkins, J., and Torr, C. W., Birmingham, "*Improvements in the construction and ornamentation of gaseliers, chandeliers, candelabra, and other lamps, and in gas brackets.*" Patent dated Feb. 18, 1875.

In suspending sliding gaseliers and chandeliers according to this invention, the pulley frame, pulleys, and parts immediately connected therewith are fixed above the central plate or rose affixed to the ceiling, and consequently are out of sight.

The balance-weights are arranged in such a manner that the weights on descending enter the interior of a vase or hollow ornament provided for their reception; or the balance may be expanded at its lower part, its under surface being properly shaped to serve as a reflector; or a purdifume may be attached to the balance-weight made of glass covered externally with perforated metal. Reflectors for gaseliers and other lamps made of perforated metal are placed upon the glass shade or globe.

Heretofore balance-weights have been made of a stamped shell or hollow casting of brass, and afterwards filled with lead or iron in order to give the requisite weight. According to this invention the body of the balance-weight is cast in lead, iron, zinc, or suitable alloy in a solid piece, and the ornaments of brass or other superior metal, and afterwards attached.

The improvements in gas brackets consist in substituting, for the ordinary wooden pattrass, a pattrass made partly of metal and partly of wood, the metal forming a cap or cover for the wood filling, through which the attaching screws pass. This improvement is also applicable to ceiling pattrasses.

In order to render it unnecessary to raise and lower the body of a gaselier, chandelier, or table lamp, when it is required to raise or lower one or more of the lights, the arms of the gaselier, chandelier, or table lamp are attached to the body of a system of jointed arms arranged in a manner somewhat similar to the parallel motion of the ordinary steam-engine. By this arrangement one or more of the arms can be raised or lowered without raising or lowering the body, the arm at all heights preserving its horizontal position. The arms may be balanced or provided with friction or clamping mechanism to prevent accidental change of position.

In fixing chandeliers, candelabra, or other like lamps according to this invention, there is attached to the ceiling plate a valve so acted upon by the down pipe of the lamp that in screwing the pipe to the ceiling plate the junction is made gas-tight before the end of the down pipe, acting upon the valve which it opens, admits the gas through the pipe. The advantage of this mode of connexion in enabling gaseliers to be placed upon or nearly upon the table in such a way that when not in use they may be conveniently removed.

APPLICATIONS FOR LETTERS PATENT.

150.—Hazlehurst, G. S., Runcorn, Chester, "Improvements in, and apparatus for, pumping liquids, and pumping and condensing gases." Jan. 14, 1876.
157.—Howarth, T., Rufford, Lancs, "An improved tap for drawing off and measuring liquids." Jan. 14, 1876.
181.—Bond, F. T., Gloucester, "Improvements in filtering and purifying water and other liquids." Jan. 18, 1876.
188.—Steel, J., Glasgow, "Improvements in the manufacture of gas, and in the machinery or apparatus employed therefor." Jan. 18, 1876.
194.—Hawkins, H., Milford Haven, Pembroke, "Improvements in apparatus used in the manufacture of gas." Jan. 18, 1876.
202.—Newton, A. V., Chancery Lane, London, "Improvements in liquid-meters." A communication. Jan. 18, 1876.
207.—Kidd, J. H., Wrexham, "Improvements in the process of and arrangements and machinery for treating excreta, house refuse, and sewage sludge, to obtain manure and other products therefrom." Jan. 19, 1876.
225.—Hanson, J., Dewsbury, "Improvements in treating sewage and other foul water, and in deodorizing and utilizing urine to be used for manure." Jan. 20, 1876.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

2545.—Wilson, M., Brixton, London, "An improved stench-trap." July 15, 1875.
2572.—Sagar-Musgrave, J. M., Akeroyd, J. B., and Ward, D., Leeds, "Improvements in pump buckets and valves for the same." July 19, 1875.
2610.—Warner, W. J., South Shields, "Improvements in machinery and apparatus for charging and discharging gas-retorts." July 22, 1875.
2620.—Hellyer, S. S., Strand, London, "Improvements in apparatus for preventing waste of water." July 23, 1875.
2632.—Morris, R. W., and Hunter, J. C., Barrow-in-Furness, Lancs, "Improvements in apparatus for registering the rise and fall of liquids." July 24, 1875.
2639.—Goldsmith, G., Leicester, "Improvements in gas-meters." July 24, 1875.
2912.—Foster, J. K. J., Wakefield, "Improvements in apparatus and appliances for raising liquids and fluids, the same being applicable as auxiliary motive mechanism for various purposes." Aug. 18, 1875.
3477.—Arrowsmith, J. J., and Ferguson, H., Liverpool, "Improvements in plugs or stoppers for tubes." Oct. 7, 1875.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

33.—Henry, M., "An improved water-gauge." Jan. 2, 1873.
44.—Buckley, S., "Improvements in the construction of a combined pipe wrench and cutter." Jan. 4, 1873.
80.—Lake, W. R., "An improved apparatus for manufacturing illuminating gas." Jan. 8, 1873.
104.—Gedge, W. E., "A new or improved water-meter." Jan. 10, 1873.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION has been AWARDED to

GWYNNE & BEALE'S PATENT IMPROVED GAS-EXHAUSTERS,

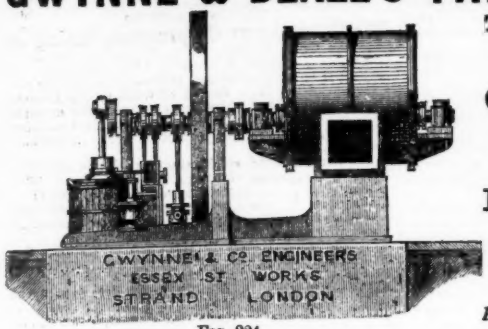

Fig. 224.

The BEST EXHAUSTERS IN THE WORLD.

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Ever produced, and the most economical in working.

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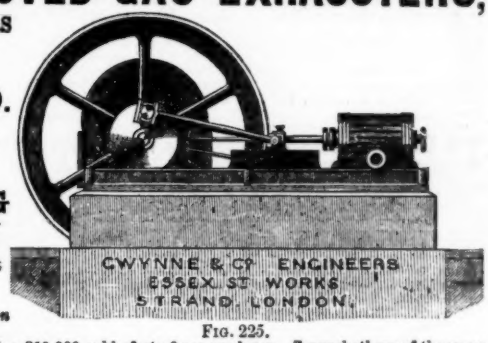

Fig. 225.

Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. Several others of the same size are now on order for the same Company. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the **most perfect system of action yet discovered.** Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 52,500 cubic feet per hour. GWYNNE AND Co. *do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality, and the most approved design and arrangement.* Their prices have been estimated with a due regard to the **excellence of the article produced,** and when this is taken into consideration, they have no fear for the result. The orders executed this season for Exhausters and alterations to their patented system amount to over 4,000,000 cubic feet of gas passed per hour, and to over 300 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction. Numerous testimonials and references can be given.

REGULATORS, BYE-PASSES, STOP-VALVES, GAS-VALVES, & MACHINERY FOR GAS MANUFACTURE, OF ALL SIZES,
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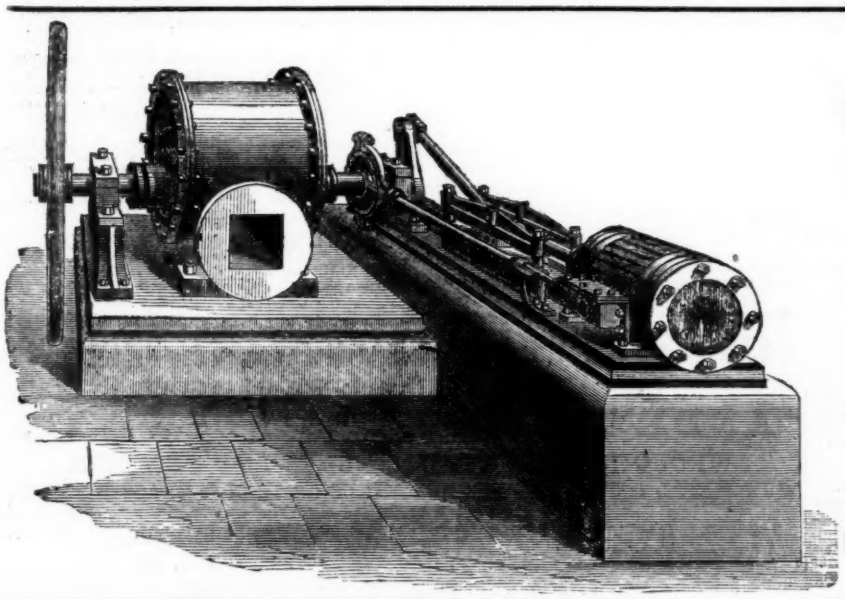
G. & Co. are now manufacturing for a London Gas Company three of their 210,000 cubic feet Patent Gas Exhausters, and many of all sizes.



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MANUFACTURERS OF WET AND DRY GAS-METERS;

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ABOVE 30,000 OF WHICH ARE NOW IN USE.

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WANTED immediately, an experienced person as Ledger and Rental CLERK. Only those accustomed to the routine of a Gas Office need apply.

Address, stating age, terms, present or former employment, &c., JOHN HUTCHINSON, Manager, Gas-Works, BARNSLEY.

WANTED, by the Advertiser, a situation as GAS-FITTER, Main or Service Layer, Meter Inspector, or to take charge of small works. Has had 17 years experience. Good reference.

Address No. 237, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by an experienced Man, a re-engagement as GENERAL MANAGER. Is well acquainted with every department of the works, keeping accounts, and carrying out of extensions and alterations. First-class testimonials and references.

Address No. 231, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, an engagement as Manager, or Manager and Secretary, of a medium-sized Gas-Work. Thorough practical acquaintance with the manufacture and distribution of gas, and the erection and repair of plant used for such purposes.

Testimonials, &c., on application to No. 236, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Advertiser, a situation as METER INSPECTOR, Fitter, Service-Layer, &c. Abroad preferred.

Address PARA, care of Mr. Smith, 60, Cornwall Road, Lambeth, LONDON.

WANTED, a re-engagement as Working MANAGER, where the make is not less than 5 millions. The Advertiser has had 20 years practical experience in the erection, management, and distribution of gas; a practical knowledge of the photometer, making of sulphate of ammonia. Is a good smith and gas-fitter. Can do his own extensions and repairs. Five years foreman erecting works, home and foreign. Good references and testimonials.

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ADVANTAGES OF GAS FOR

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HINTS ON GAS BURNERS, &c.

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Specimen Copy by post Threepence, direct from MAGNUS OHREN, Gas-Works, Lower Sydenham, London, S.E.

WANTED, by the Advertiser, aged 29, a re-engagement as ASSISTANT MANAGER, Chief Rental Clerk, Outdoor Inspector, or to take charge of a medium-sized works. Has had 12 years experience, both at home and abroad. Uses the photometer. Good testimonials and references.

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SITUATION AS DRAUGHTSMAN WANTED.

A GENTLEMAN, aged 24, having had three years experience with Gas Engineers, well up in general and detail drawings, and able to prepare specifications, seeks an ENGAGEMENT as above. Knowledge of foreign languages. Excellent references.

Address C. C., Box 36, Post Office, LINCOLN.

CITY OF DURHAM.

GAS MANAGER.

THE Directors of the City of Durham Gas Company are desirous of obtaining the services of a practical experienced MANAGER for their Gas-Works. Present make of gas about 53 millions per annum.

Applications, in own handwriting, stating age, experience, and salary required, accompanied with testimonials, endorsed "Gas Manager," to be sent on or before Tuesday, the 1st of February, addressed to the CHAIRMAN, Gas Company, DURHAM.

A Young Gentleman, who has always been accustomed to Gas-Works, and whose family is associated with Gas Engineering, wishes to enter upon an engagement either as MANAGER, Sub-Manager, or Clerk to a Gas Company of moderate size. Has a fair knowledge of gas work, and a thorough knowledge of gas accounts. The county of Derby preferred. Can furnish good testimonials and references as to ability and reputation.

Further particulars can be obtained by addressing No. 242, care of Mr. King, 11, Bolt Court, Fleet Street, LONDON, E.C.

TO BE LET—The Colnbrook Gas-Works, from the 31st of March next on LEASE.

Full particulars to be obtained of the Secretary, Mr. WILLIAM STRANSON, Colnbrook, Slough, BUCKS.

Tenders to be sent in on or before Feb. 3, 1876.

STATION-METER for Sale, in good condition (Makers West and Gregson) in very ornamental case, fitted up with tell-tales, inlet, outlet, and bye-pass valves, and 12-in. connexions. Passes 25,000 cubic feet per hour. Now replaced with a larger one.

For price, &c., apply to JOHN W. WHITAKER, Manager, Gas-Works, WAKEFIELD.

FOR SALE—Gasholder, 30 ft. by 10 ft.; one new ditto, 20 ft. by 10 ft.; one ditto, 18 ft. by 10 ft., in iron tank complete; one ditto, 9 ft. by 8 ft., in iron tank complete. Also two ditto for experimental purposes. Two Purifiers, one 8 ft. by 5 ft. by 3 ft. double; one ditto, 4 ft. by 4 ft. by 3 ft. 3 in. complete. One 4-in. Condenser, with 120 ft. of pipe complete. All connexions of above are 4-in. To be sold together or separately, and cheap.

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TO IRONFOUNDERS AND GAS ENGINEERS.

FOR SALE, by Private Contract, that old-established BUSINESS, Plant, and Stock-in-Trade of an Ironfounder and Gas Engineer, for many years successfully carried on by the late John Vickary, and since his decease by his Widow and Sons, as "VICKARY & SONS." The premises are commodious, and conveniently near the Bristol and Exeter Railway, the London and South-Western Railway, and the Exeter Basin.

For particulars, apply to Messrs. W. L. Harrison, 37, Cannon Street, Birmingham; J. O. Harris, Gandy Street Chambers, Exeter; and Thomas Andrew, 13, Bedford Circus, Exeter; or to Mr. Merlin Fryer, Gandy Street, Exeter, their Solicitor.

THOMAS ANDREW, Acting Trustee.

13, Bedford Circus, Exeter, Jan. 3, 1876.

WIDNES WATER-WORKS.

THE Widnes Local Board are prepared to receive TENDERS for the construction of a covered RESERVOIR (to contain 10 million gallons), to adjoin their present one on Pex Hill.

Plans may be seen, and specifications obtained, at the Engineer's Office, Public Offices, Widnes, on and after the 27th inst.

Tenders to be addressed to the Chairman of the Gas and Water Committee, endorsed "Reservoir," and delivered at the above Offices not later than the 4th of March next.

The Board do not bind themselves to accept the lowest or any tender.

HENRY ROBERTS.

Widnes, Jan. 19, 1876.

EXETER GASLIGHT AND COKE COMPANY.

THE Directors of the above Company invite TENDERS for the supply of from 5000 to 10,000 tons of North Country GAS COALS (unscreened), such coal to be either of the following descriptions:—New Pelton, South Pelton, Holmside, Pelaw Main, or coal of equal quality, and to be shipped, f.o.b., at Newcastle or Sunderland during the present year.

The Contractor to state for which coal he tenders.

Sealed tenders, endorsed "Tender for Gas Coals," to be sent to me, the undersigned, on or before the 14th day of February next.

The Directors do not bind themselves to accept the lowest or any tender.

W. A. PADFIELD, Secretary.

TO IRONFOUNDERS.

THE Directors of the Flint Gas and Water Company (North Wales) are prepared to receive TENDERS for about 2800 yards of 6-in. SOCKET-PIPES, turned and bored. Weight 86 lbs. per yard. Proved to sustain a pressure of 200 ft. head of water, and perfect in every respect. Also for the necessary connexions and a few Double-Faced Sluice-Valves, with brass faces and screws.

The whole to be delivered free at the Railway Station, Flint, North Wales.

Tenders to be delivered on or before the 5th of February next, addressed to Mr. WM. RICHARDSON, Gas and Hydraulic Engineer, 62, Pershore Road, Edgbaston, BIRMINGHAM.

The Directors do not bind themselves to accept the lowest or any tender.

IN THE MATTER OF

BRONNER'S GAS-BURNERS.

HENRY GREENE AND SON, 155, Cannon Street, London, Sole Agents for Great Britain, Ireland, and Colonies, of Brönner's Improvements in Gas Lighting, beg to inform the public that on the 13th of January, 1876, Julius Brönner obtained an injunction in the Court of Session, Scotland, against Donald M'Vean, Gas-Fitter, 14, Newton Street, Glasgow, prohibiting him from in any way advertising or offering for sale as Brönner's Burners, any Burner not manufactured by Julius Brönner, or from in any way inducing the public to believe that the said Donald M'Vean sells or keeps for sale Brönner's Burners, manufactured by Julius Brönner, while such is not the case.

Also that on the 9th of November, 1875, he obtained injunction in the same Court, and in the same terms, against R. M. Brechin and Co., 46, North Hanover Street, Edinburgh.

Also that on the 20th of April, 1875, in a suit in Chancery, before Vice-Chancellor Malins, number 1874, B 365, he obtained injunction against another defendant, in the same terms and on similar grounds.

TO MANUFACTURING CHEMISTS AND OTHERS.

THE Directors of the Ashford Gas and Coke Company invite TENDERS for the surplus TAR and the whole of the AMMONIACAL LIQUOR produced at their works, for One or Two years, as may be agreed on.

Particulars may be obtained on application to the undersigned, to whom tenders, under cover, must be addressed, on or before the 5th of February next.

JOHN MORTON, Manager.

LEICESTER WATER-WORKS.

THE Directors of the Leicester Water- Works Company are prepared to receive TENDERS for the construction of a covered service RESERVOIR at Gilroes, near Leicester.

Drawings and specifications may be inspected, and forms of tender and schedule of quantities may be obtained, at the Offices of the Company, Bowling Green Street, Leicester, and at the Office of Messrs. Thomas and Charles Hawksley, Civil Engineers, 30, Great George Street, Westminster, S.W., on and after Monday, the 24th day of January inst., and tenders must be delivered at the Offices of the Company, at or before Ten o'clock in the forenoon of Saturday, the 19th day of February next.

The Directors do not pledge themselves to accept the lowest or any tender.

By order,

J. H. WILLIAMS, Secretary to the Company.

Leicester, Jan. 17, 1876.

THE Sheffield United Gaslight Company have for SALE the following Articles:—

The whole Manufacturing Plant, Gasholder, and Governor, of a small Gas-Work, capable of producing 10,000 cubic feet of gas per day. The gasholder is 27 ft. diameter by 14 ft. deep, cubic contents 8000 ft.

Connexions for ditto.

Four Purifiers, 12 ft. square, with 10-in. centre-valve and connexions.

Two Purifiers, 12 ft. square with 18-in centre-valve.

Two Jones's Exhausters, each to pass 25,000 cubic feet per hour, with valves and connexions, in good condition.

Two 7-in. Governors.

One Scrubber 8 ft. diameter, 18 ft. high, with 12-in. connexions and valves.

One Battery Condenser, 60 ft. long, 12 ft. high, and 2 ft. wide, with 14-in. connexions and valves.

Seven Lengths Hydraulic Main, 7 ft. long, 18 in. diameter.

Nine Lengths Hydraulic Main, 7 ft. long, 14 in. diameter.

Twenty-seven Dip-Pipes, 4 in. diameter.

Twenty-seven Bridge-Pipes, 4 in. diameter.

Full particulars as to quality and price can be obtained on applying to Mr. T. ROBERTS, the Manager, Commercial Street, SHEFFIELD.

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CROSBY, LOCKWOOD, AND CO., 7, STATIONERS HALL COURT, LONDON.

SOUTHPORT CORPORATION.—MAIN SEWERAGE WORKS.

TO CONTRACTORS.

THE Southport Corporation, acting as the Urban Sanitary Authority, hereby give notice that they are desirous of receiving TENDERS from competent persons willing to enter into a contract for the construction of the Main Outfall SEWER to the Crossens Channel, and several Main Branches, with the necessary screening chamber, side entrances, man-holes, ventilators, penstocks, flushing gates, and other works incidental to the above.

The plans, sections, and drawings may be now seen at the Office of Mr. James Mansergh, the Engineer, 3, Westminster Chambers, Victoria Street, London, and at the Town-Hall, Southport, where also printed specifications and bills of quantities may be obtained on payment of two guineas.

Sealed tenders, endorsed "Main Sewerage Works, Contract No. 1," are to be delivered at my Office, on or before Saturday, the 7th day of February next.

The Corporation do not bind themselves to accept the lowest or any tender.

KEIGHLEY WALTON, Town-Clerk.

Town-Hall, Southport.

THE GASLIGHT AND COKE COMPANY.

NOTICE is hereby given that, pursuant to the Standing Orders of both Houses of Parliament, an EXTRAORDINARY GENERAL MEETING of the SHAREHOLDERS of The Gaslight and Coke Company will be held at the Company's Office, Horseferry Road, Westminster, on FRIDAY, the 4th day of February next, at Twelve o'clock (noon) precisely, when a Bill now pending in Parliament, intituled "A Bill for granting further powers to The Gaslight and Coke Company, and for other purposes," will be submitted to the Proprietors, then present in person or by proxy, for their approval.—By order of the Directors,

JOHN ORWELL PHILLIPS,
Secretary to The Gaslight and Coke Company.

Dated this 17th day of January, 1876.

WHY sell your Liquor when it pays you better to work it up yourself?

Consult J. JUDGE, Chemical Burner, who has put up several sets of Apparatuses for Gas-Works. Success sure and nuisance got rid of. Saturating Tanks, &c., made to order.

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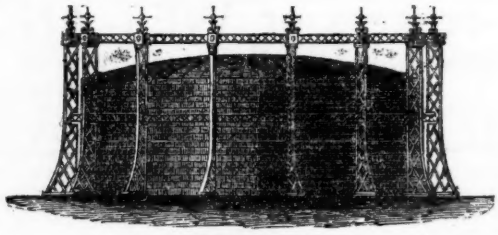

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It is required, under a PENALTY OF FIVE POUNDS, that a PRINTED COPY of the 4th SECTION of the above Act shall be posted up at all Gas and Water Works in a conspicuous place, where the same may be conveniently read by the persons employed thereat.

Printed copies of the section, in large type, on broad sheets, may be had of WILLIAM B. KING, 11, Bolt Court, Fleet Street, LONDON. Price, per post, 2s. per dozen, or 10s. 6d. per 100.

The Act came into operation on Sept. 1, 1875, and extends to Scotland and Ireland.

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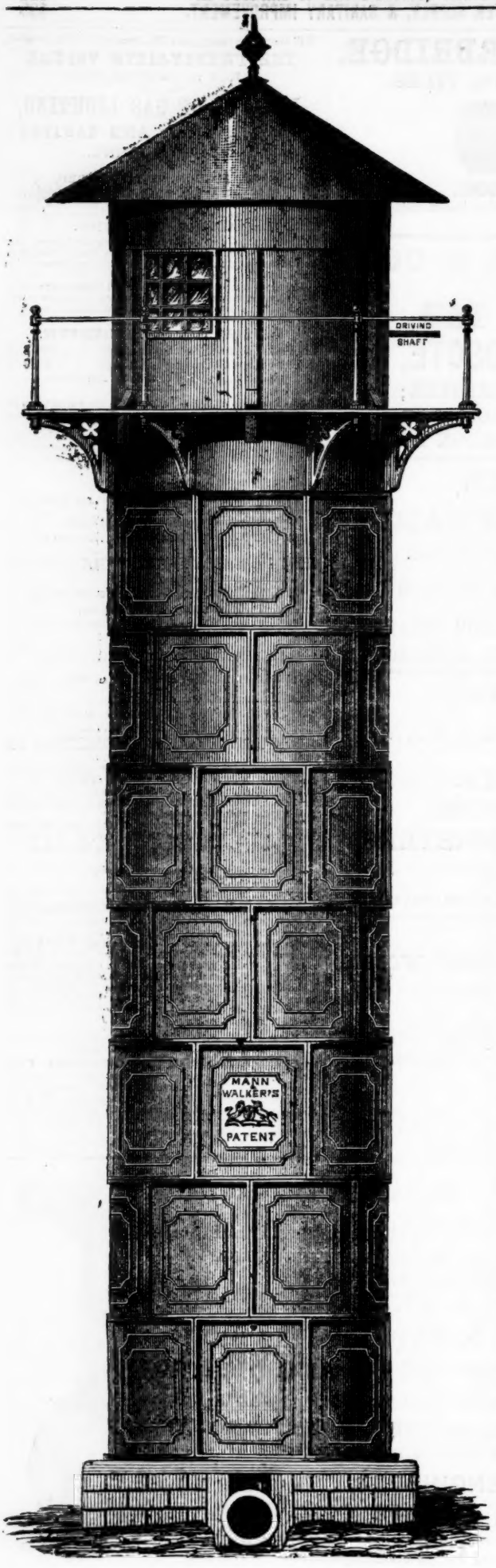

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By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

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Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

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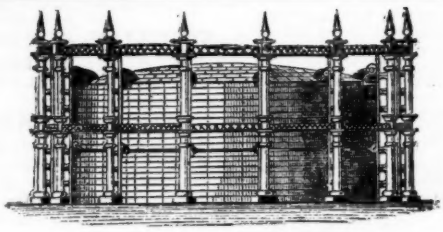

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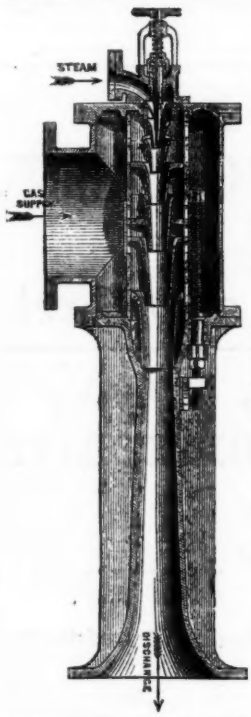

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ALL Persons having any Claim or DEMAND upon the said Company, which has resolved to wind up its affairs voluntarily, pursuant to the Companies Act, 1862, and has appointed JAMES TERTIUS COLLINS, the Chairman, and THOMAS BULLOCK the younger, the Deputy-Chairman; together with Edward Bembridge, Edward Davenport, Frederick Everitt, Josiah Kempson, David Malins, and James Watson, the Directors, to be Liquidators of the said Company, are hereby required to SEND their full Christian and Surnames, and their Addresses, and the PARTICULARS of their Claims or Demands to the Liquidators of the said Company, at the Office of Mr. Joseph Slocombe, Public Accountant, No. 16, Bennett's Hill, Birmingham, on or before the 31st day of January, 1876, or in default thereof the Liquidators will proceed to wind up the said Company, and distribute the Assets thereof among the parties entitled thereto, having regard only to the Claims and Demands of which they the said Liquidators shall then have had notice.

JOHNSON, BARCLAY, AND JOHNSON,
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MANUFACTURE AND DISTRIBU- TION OF GAS. These sheets are the same as were laid before the Dublin Meeting of the British Association of Gas Managers; but in the REPRINT, NOTES have been added for the guidance of those using them. Copies of the two sheets may now be had, price 5s.

South Shields. W. J. WARNER.

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Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

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Yields 13,320 cubic feet of 32·5-candle gas per ton.
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STRONGLY RECOMMEND A TRIAL OF THEIR
CELEBRATED SILKSTONE GAS NUTS.

Analysis by F. J. EVANS, Esq., Chartered Gas Company, Horseferry Road, Westminster:—

(COPY.)

	Cubic Feet of Gas per Ton of Coal.	Illuminating Power in Candles.	Coke per Ton of Coal used.	Ash in Coke, per Cent.	Sulphur in Coal, per Cent.
Silkstone Nuts . . .	10·800	15·85	12·66 cwt.....	6·0	0·69

NOTE.—The illuminating power of the gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.

Horseferry Road, Westminster, March, 1870. (Signed) F. J. EVANS.

These Nuts are extensively used by various Gas Companies throughout the Kingdom, who bear strong testimony to their value.

APPLICATIONS FOR PRICES, &c., TO BE SENT DIRECT TO THE COLLIERY, AS ABOVE.

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(Successors to JOHN WILLIAM O'NEILL & CO.,)

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THE DERBYSHIRE

SILKSTONE COAL COMPANY, LIMITED,

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GAS COAL

Of superior quality, delivered at any station in England and Wales.

Purified gas per ton of coal in cubic feet (average)	10,775
Weight of coke in lbs. per ton of coal	1,465

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1. The following are the practical results given by Dr. Wallace, of Glasgow, of analyses of their Lochore and Capledrae Cannels:—

	Sample worked at Capledrae.		Sample worked at Lochore.
Gas per ton of coal, at 60° Fahr. and 30 inches barometric pressure . .	13,095 cubic feet.	..	11,760 cubic feet.
Illuminating power, in standard sperm candles, by union jet consuming 5 cubic feet per hour, at ·5-inch pressure	32·91	..	34·83
Value of 1 cubic foot of gas in grains of sperm	780	..	836
Equivalent of a ton of coal in pounds of sperm candles	1,459	..	1,404
Durability of 1 cubic foot by 5-inch flame	69 minutes.	..	71 minutes.
Gravity of the gas (air = 1000)	596	..	594

Remarks.—This (the sample from Capledrae) is a Cannel Coal of first-class quality, giving 13,000 feet of 33-candle gas. It contains only a minute proportion of sulphur, and the ash is almost quite white. The coke is of rather inferior quality.

Remarks on Sample from Lochore.—This is a Cannel Coal of first-class quality, giving a large yield of very rich gas and a coke of medium quality.

2. The following are the practical results of analyses by Dr. Wallace of the Company's Waverley Cannels:—

	Capledrae Waverley.		Lochore Waverley.
Gas per ton of coal, at 60° Fahr. and 30 inches barometer	9,120 cubic feet.	..	11,145 cubic feet.
Illuminating power, in standard candles, by union jet consuming 5 cubic feet per hour, at ·5-inch pressure	36·62	..	33·09
Value of 1 cubic foot of gas in grains of sperm	878	..	794
Equivalent of a ton of coal in pounds of sperm candles	1,145	..	1,264
Durability of 1 cubic foot of gas by 5-inch flame	80 minutes.	..	67 minutes.
Gravity of the gas (air = 1000)	677	..	597

Remarks on the Sample of Capledrae Waverley.—This Coal gives fully 9000 feet of gas of 36½ candles, and is admirably adapted for bringing up the quality of gas made from common coal or inferior qualities of cannel. The tests were made at a rather high temperature, this being one of the coals that stand a very high heat without serious diminution of the illuminating power of the gas The coke contains 60 per cent. of ash, and is therefore almost valueless, but the proportion of sulphur is very moderate.

Remarks on the Lochore Waverley.—This is a first-class Cannel Coal, giving 11,000 cubic feet of 33-candle gas. The quantity of sulphur is very minute, and the ash is nearly white. The coke is of inferior quality, but not wholly valueless.

Applications for full Copies of Analyses and Prices may be made to the Company, at

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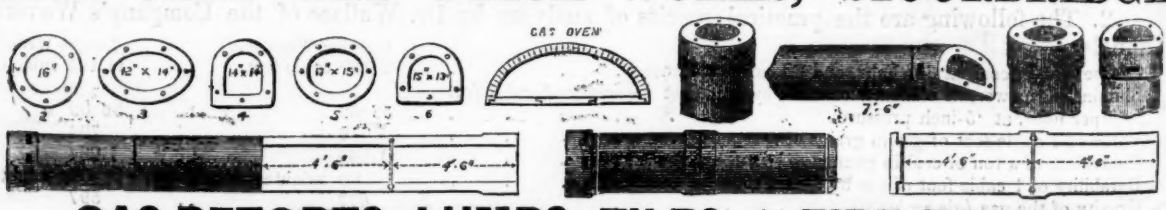

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